Commercial Fisheries Abstracts

a monthly summary of important developments for the fishery industries

In this issue—

- Aluminum Alloys in Ships, p.1
- New Type Meal Dryer, p.3
- Bactericides in Ice, p.5
- Iodo-amino Acids, p.7
- Pepsin from Fish Stomachs, p.9

—and 31 others

SEP 1954
LIBRARY
POFI
FISH & WILDLIFE
SERVICE

Vol.7 No.9 September 1954

Fish and Wildlife Service
U.S. Department of the Interior
Washington D.C.

UNITED STATES
DEPARTMENT OF THE INTERIOR

DOUGLAS McKAY, Secretary

FISH AND WILDLIFE SERVICE

JOHN L. FARLEY, Director

Commercial Fisheries Abstracts

Prepared in the Branch of Commercial Fisheries

EDITORS

A. W. ANDERSON, Chief, Branch of Commercial Fisheries

DONALD Y. ASKA, Chief, Educational and Market Development Section

ASSOCIATE EDITOR

MAURICE E. STANSBY, Chief, Pacific Coast and Alaska Technological Research

ASSISTANT EDITOR

ROY C. STEVENS, Fishery Products Technologist, Seattle

Applications for COMMERCIAL FISHERIES ABSTRACTS, which is mailed free to members of the fishery industries and allied interests, should be addressed to the Director, Fish and Wildlife Service, United States Department of the Interior, Washington, 25, D.C.

Fulfillment of foreign requests confined to Government agencies, research institutions, and libraries.

The Service assumes no responsibility for the accuracy of material from outside sources, and can fulfill requests for copies of the articles only if the abstract was taken from a Service publication. Readers should direct requests for other articles to the author of the article or to the publication in which it appeared. The addresses of these publications are available from the Fish and Wildlife Service, Washington 25, D. C., and will be sent to inquirers upon request.

The abstracts in this leaflet may be left in their present form; but it is suggested that to make the most efficient use of them, they be cut out on the lines designated and filed by the number in the upper left-hand corner of each. For a full description of this filing system see "Fishery Technological Abstract Card System" by Maurice E. Stansby and K. L. Osterhaug, Fishery Leaflet No. 232, obtainable free by request from Fish and Wildlife Service, Washington 25, D. C.

In addition to the regular abstracts, there is included a bibliography of references of secondary importance (without abstracts). These may be cut off on the lines designated and pasted on standard 3 x 5-inch cards for filing.

Following is a brief outline of this filing system. The numbers apply to the first digit appearing on each card. For the meaning of subsequent digits, please see the above described leaflet.

0	General and theoretical	5	Vitamins
1	Fish by species	6	Fishery byproducts
2	Fresh fish	7	Analytical Methods
3	Preserved fish	8	Composition
4	Oils	9	Miscellaneous

Issued with the approval of the Bureau of the Budget, December 29, 1953

8.0 FOOD COMPOSITION TABLES -- MINERALS AND VITAMINS -- FOR INTERNATIONAL USE

Chatfield, Charlotte (Nutrition Division)
Food and Agriculture Organization of the United Nations, Rome, Italy (March, 1954) 118 pp.

The contents of the publication are as follows:

Table 1. "Food Composition in Terms of the Retail Weight (As Purchased)."

A tabulation of the calorie, protein, fat, calcium, iron, vitamin A, thiamin, riboflavin, niacin, and ascorbic acid content of 292 food items.

Table 2. "Composition of the Edible Portion and Refuse in the Material As Purchased."

A tabulation of the water, calcium, iron, vitamin A, thiamin, riboflavin, niacin, ascorbic acid, and refuse content of 292 food items.

Table 3. "Composition of the Edible Portion and Refuse in the Material As Purchased: Proximate Composition of New Items."

A tabulation of the water, protein, fat, total carbohydrate, fiber carbohydrate, ash, calorie, and refuse content of 38 food items.

Five hundred and thirty nine bibliography references are cited.

2.1127 MARINE BAIT-WORMS -- A NEW MARITIME INDUSTRY

MacPhail, J. S. (Atlantic Biological Station, St. Andrews, N. B.)
Fisheries Research Board of Canada, Progress Reports of the Atlantic Coast Stations, No. 58, 11-16 (April, 1954)

The United States salt-water sport fishery that extends from Connecticut to Maryland uses two commercially-valuable marine worms -- the "sandworm" or "clamworm" (Nereis virens) and the "bloodworm" (Glycera dibranchiata) -- for the capture of many species of fish including blackfish, bluefish, fluke, kingfish, porgy, weakfish, sea bass, striped bass and flounder. With the rapid growth of the sport fishery since 1945, the demand for bait-worms has increased so much that the demand has at times exceeded the supply. In 1949 the first United States interests appeared in Canada looking for worms.

The establishment of a bait-worm fishery is limited by several factors. Since the landed value of bait-worms is about $1.00 to $1.25 per hundred, they should be present in such numbers that a digger can gather a minimum of 400 to 500 at each low-tide period in order to make fair compensation. There should also be a supply of suitable "packing weed" in the immediate vicinity. The material most commonly used is a fibrous seaweed (Ascophyllum mackaii). Ordinary rockweeds are unsuitable because they rot quickly, killing the worms with slime, or they are too heavy. The fishery should be located convenient to an air freight depot to assure minimum transportation costs for the perishable product being shipped. A seasonal labor supply must also be available.

Of the entire coast area examined, only one large area appeared to contain bloodworms in commercial quantity. It includes Yarmouth Harbor, Little River, Goose Bay, Pubnico Harbor and Jordan River. Although the average size of the worms shipped from the area was somewhat smaller

(over)

 ABSTRACTER: Kathryn L. Osterhaug

2.113 THE PERFORMANCE OF ALUMINUM ALLOYS IN SHIPS

Lees, D. C. G.
Chemistry and Industry, No. 22, 628-9 (May 29, 1954)

Suitably chosen aluminum alloys were found to be highly resistant to sea spray when subjected to exposure tests. These findings are supported by the present good condition of a number of small boats built during the early 1930's.

Examples of the corrosion of aluminum incorporated in vessel structures showed that corrosion need not have occurred if the recommended practices had been followed. The causes of corrosion in aluminum incorporated in vessels were due to (1) the direct connection of aluminum to steel without suitable insulating material between the two metals, (2) the use of propellers without sacrificial anodes to protect the aluminum hull, (3) application of anti-fouling compositions containing mercury, and (4) chafing of paint by steel hawsers which brought the two metals into direct contact.

Recommendations toward eliminating corrosion difficulties of the foregoing type were outlined by the author. Where aluminum plating is riveted to a steel boundary angle, the vertical flange should be high enough to bring the line of rivets well clear of the timber deck and the resulting joint should be completely self-draining. Insulating materials placed between steel and aluminum must be non-absorbent, e.g. neoprene, polyvinyl chloride or bituminous damp course. As an alternative, the steel may be coated with aluminum, zinc, or cadmium by hot dipping, spraying, or electroplating, as may be most convenient. Priming paints pigmented with lead compounds are not recommended for aluminum on board ship. Primers containing zinc chromate or zinc tetroxychromate are preferred. Organic poisons containing arsenic have received considerable attention as anti-foulings. Satisfactory service, however, can be obtained with copper-containing anti-foulings if a zinc chromate primer is

(over)

 ABSTRACTER: Martin Heerdt

6.3 D-GALACTOSE

Black, W. A. P. and Cornhill, W. J. (Institute of Seaweed Research, Inveresk, Midlothian)
Chemistry and Industry, No. 18, 514-16 (May 1, 1954)

D-galactose, a natural component of pectins, gums, and mucilages, occurs abundantly and chiefly as a galactan in a wide variety of plant materials. Agar and carrageenin extracts obtained from the red seaweeds (Rhodophyceae) are galactan sulfates which yield 30 to 50 percent D-galactose on acid hydrolysis. Ross (1953) has shown that practically every species of red seaweed with any appreciable amount of sulfate contains galactose as the primary sugar. The exceptions are the general Rhodymenia (dulse) and Rhodochorton which contain xylose, and Corollina which contains glucose as the primary sugar.

Galactose has been considered as a substitute for lactose which is now used in the substrate in which antibiotic-producing organisms are grown.

A number of red seaweeds and terrestrial plant materials such as Sphagnum, peat, heather and bracken, all of which are indigenous to Britain, have been analyzed for galactose. The method of analysis used consisted essentially of running, with controls, a one-dimentional 48-hour chromatogram (Tate and Lyle solvent, 1950) of an acid hydrolyzate of the sample. After cutting out the strips and eluting with cold water, the individual sugars were determined with hypoiodite. The results of the analysis (Table I, this card, over) show that the best sources of galactose are the red seaweeds used in the production of agar and carrageenin. At the present time, about 14,000 tons of dry agar- and carrageenin-containing red marine algae are collected and processed annually in thirteen maritime countries. The littoral zone of certain British shores has been surveyed for Chondrus crispus and Gigartina stellata but little is known about Britain's other underwater red seaweed

(over)

 ABSTRACTER: Martin Heerdt

2.113

applied first. Hulls fitted with gun-metal propellers should be protected by sacrificial anodes. Until the present time these anodes usually have been made from zinc, but increasing interest has been shown in magnesium anodes.

6.3

resources. However, tens of thousands of tons of red seaweeds are cast up each summer on the South Coast in the Worthing area. An analysis of this cast weed appears in the table.

Table I

% Composition of miscellaneous samples (dry basis)

Sample	Total reducing substances calc. as anhydro hexoses	% Galactose	% Glucose	% Xylose	% Arabinose
Gigartina stellata					
North Berwick, 10.6.52	41·3	21·1	N.D.	N.D.	*
Furcellaria fastigiata					
Galway Bay, 15.12.51	29·2	18·5	5·1	3·7	*
Porphyra umbilicalis					
North Berwick, 24.4.52	43·2	16·6	N.D.	N.D.	*
Ceramium rubrum					
North Berwick, 10.6.52	30·3	14·7	10·5	3·3	*
Polysiphonia fastigiata					
North Berwick, 10.6.52	N.D.	9·6	N.D.	N.D.	*
Cast weed					
Worthing, 17.8.53	23·9	9·3	8·2	4·2	*
Sphagnum					
Dunmore, 3.7.53	28·4	11·0	5·9	5·6	2·9
Heather (whole plant) (in bud)					
Culross, 15.7.53	28·1	6·1	N.D.	5·4	1·7
Bracken fronds and stipes					
Culross, 15.7.53	25·2	3·7	11·3	1·0	2·4
Bracken rhizomes					
Culross, 15.7.53	32·3	4·7	17·3	1·6	3·9
Hop bine					
(Whitbreads)	24·3	3·6	N.D.	14·4	N.D.
Dunmore peat					
Stirlingshire, 3.7.53	42·3	10·5	8·3	3·9	5·0
Benhar peat					
Lanarkshire	11·8	4·9	4·4	5·9	N.D.
Bargeddie peat					
Lanarkshire	16·1	4·3	6·5	4·3	N.D.
Gardrum peat					
Stirlingshire	17·9	4·1	4·3	3·8	N.D.
Halladale peat					
Sutherland	14·9	4·6	2·6	N.D.	N.D.

N.D.—not determined. *—absent.

8.0 (Cross References: 8.42, 8.6)

2.1127

than that of the regular Maine shipments, the facilities for handling worms were excellent and prospects for an industry there appeared good.

Little is known about the biology of the bloodworm that would be helpful in judging the future prospects of the industry. In the spring of 1953 the Atlantic Biological Station initiated an investigation at Yarmouth County, Nova Scotia, on the biology of the bloodworm with particular emphasis on the effects of fishing on the stocks. Exploratory work is being continued in the most promising areas.

3.19 THE PRESERVATION OF FOOD WITH IONIZING RADIATIONS

Hannan, R. S. (Low Temperature Station for Research in Biochemistry and Biophysics, Cambridge)
Food Science Abstracts 26, No. 2, 121-126 (March, 1954)

Since 1947, various types of ionizing radiations have been investigated for the treatment of food, primarily with a view to killing microorganisms without heat. Radiation suitable for foods may be obtained by means of electron generators of various types designed to work at high voltage and high power output, or as a waste product from the large-scale utilization of atomic energy. Radiation costs at least would be economical for the treatment of highly priced foods. The processes range from complete sterilization with a dose of 2×10^6 rep to disinfestation with a low dose of the order of 2×10^4 rep.

The chemical changes produced by ionizing radiations are so unusual that they require a distinct branch of chemical study: radiochemistry. Oxidative free-radical types of reaction usually predominate; but reduction, polymerization, and degradation of large molecules can also occur. The more serious effects in foods are usually of two types: (1) reactions of free radicals and compounds such as hydrogen peroxide derived from decomposition of the water present -- these effects are frequently oxidative; and (2) a series of unusual effects in fats, again largely oxidative in nature.

The main effects to be considered are usually: (a) objectionable flavor and odor, either 'goaty' (a characteristic irradiation odor) or 'tallowy' due to oxidation; (b) changes in color, e. g., browning of red meat or bleaching of fats; (c) changes in texture, e. g., of fruits and vegetables; (d) increased susceptibility to change on storage, e. g., autoxidation of fats due to destruction of antioxidants; (e) extensive destruction of constituents present only in small amounts, e. g., vitamins; and (f) formation of physiologically harmful compounds. Susceptibility to these changes varies widely. Carrots and asparagus show relatively small changes in flavor and texture even with doses of 2×10^6 rep.

(over)

 ABSTRACTER: Martin Heerdt

3.249 INVESTIGATION OF CHANGES THAT TAKE PLACE IN FOODS DURING STORAGE IN THE FROZEN CONDITION

Lund, Arnold J.
Hormel Inst., Univ. Minnesota Ann. Rept., 70-9 (1951-52)
Chemical Abstracts 48, No. 7, 4131 (1954)

Yeast ext. contains an unidentified factor which confers resistance to the killing effect of freezing on yeast cells grown aerobically in the presence of yeast ext. Drip, or liquid loss from tissues after thawing, was studied with yeast cells as the tissue and measuring the loss of phosphates as a quant. index of the loss of sol. tissue components. By this method, no drip can be detected until the yeasts have been frozen for at least 1 hr. at -10°, but 6 hrs. at this temp. does not result in as much fluid loss as 5 min. at -72°. After freezing for 10 min. at -20°, a significant loss occurs after thawing, with a progressive increase in the loss as the freezing period is increased up to 4 hrs. Freezing at -40° and -72° are equal in effect, and 5 min. at these temps. is as effective as 6 hrs. at -20°. Trichloroacetic acid (TCA) will ext. 44% of the total phosphate from yeast cells, but after freezing, water extn. followed by TCA extn. removes 54% of the total phosphate. Pork stored at -5° shows significant deterioation of the fats within 112 days. No measurable changes occur in beef at this temp, within 260 days. Neither pork nor beef stored at -20° and -30° show any measurable deterioration after 1 year of storage. Definite evidence for the existence of a bacterial lipoxidase has been obtained in a number of bacterial cultures which possess widely different morphological and physiol. characteristics. Apparent differences in substrate specificity between methyl linoleate and Na linoleate are probably the result of the relation between the cell surface and the substrate. The oxidative ability of the cultures with respect to these unsatd. substrates was found to be cyanide-sensitive and is probably due to cytochrome. The O uptake by bacteria incubated in contact with the unsatd. substrates is not proportional to the changes produced in the ultraviolet absorption

(over)

 Reprinted in whole

6.131 NEW TYPE DRYER INSTALLED IN NEW JERSEY PLANT

Anonymous
Fish Meal and Oil Industry Yearbook, 13 (April, 1954)

A new type dryer has recently been installed at a Wildwood, New Jersey plant. It is said to differ from conventional dryers in several respects. The main difference is that it does not have a straight cylinder, but rather a single shell of widely varying diameters.

The writer states that the material velocity through a standard horizontal dryer of uniform diameter would be constant, except for the effects of changes in material particle size (as they become lighter and finer) and the increase in mass velocity because of the increased evaporated moisture. This increased material velocity is an undesirable characteristic of the single diameter cylindrical dryer, especially for materials containing internal moisture that can be removed only by allowing the moisture sufficient time to diffuse to the surface of each particle before it is evaporated. If this internal moisture is to be removed, the dryer must often be operated at higher temperatures than would otherwise be necessary, sometimes overdrying or even scorching the surface of the material in order to maintain full capacity.

In the operation of the new type dryer the heated air from the furnace enters the narrow dryer throat together with the material. A large amount of the surface moisture is evaporated from the material almost immediately without damage, since the wet bulb temperature stays low and the surface is saturated. Because of high velocities and temperatures, transmission coefficients in the throat are high. The material then moves into a larger diameter section of the dryer where it moves more slowly and where the rate of evaporation is slower because of lower temperatures and air vapor velocities. From this point on, evaporation becomes principally a function of time. The material

(over)

 ABSTRACTER: Roy C. Stevens

3.234 FISH RESEARCH

Anonymous
Food Manufacture 29, No. 6, 223-224 (June, 1954)

The pilot-scale size vertical plate freezer that has been designed at the Torry Research Station for freezing fish is believed to be suitable for use on existing fishing vessels. Since the rate at which fish are caught is variable and the space available for freezing on board is usually very limited, fish may have to be stored in ice for some time before they can be frozen. Fish have been successfully held in ice for at least 3 days without loss in quality while regulating supplies to the freezing unit. For freezing, fish should be gutted and washed according to normal trawler procedure for iced fish. An inferior product usually results if the fish are frozen ungutted.

The advantage of storing fish at very low temperatures, e. g., -22° F. is accentuated if the fish receive proper storage in ice when they cannot be frozen immediately after capture. The use of a low storage temperature permits greater latitude in the pre-freezing treatment.

A new air-blast freezer has been constructed for use in studying the many factors involved in freezing. The effects of different rates of freezing on ice formation and cell structure in fish appear to be very complicated. Research on the effect of these variables is expected to provide data for freezer design purposes.

 ABSTRACTER: Martin Heerdt

IRRADIATION PRESERVATION

NEW TYPE DRYER

CHANGES DURING FROZEN STORAGE

FREEZING FISH AT SEA

6.131

then enters a wide-diameter section known as the retention section, where temperatures are automatically maintained so low that they will not injure the material, even in its dry state. The length of time the material remains in this section is very important for the quality of the finished product. Retention time is controlled by regulating the air volumes taken through the dryer and by special unloading flights. When the material is dry it is then unloaded mechanically through a narrow section. The "fines" are pneumatically picked up by the fan and discharged through the cyclone. The dried product is then ready for grinding and bagging.

3.234 (Cross Reference: 2.19)

3.19

Milk and other dairy products, in contrast, develop objectionable tallowy flavors with very low doses. A dose of about 10^5 rep can be regarded as a threshold dose for flavor change. Current research is concerned primarily with minimizing the undesirable effects produced in foods. The methods proposed are of two types: (1) Freezing to a very low temperature, which decreases the chemical effects much more than the biological; removal of oxygen is an added advantage; and (2) Addition of relatively large amounts of a radio-sensitive compound which localizes the chemical changes. These changes take place in the added compound rather than in the food itself. Protective compounds include ascorbic acid, nitrite, and various fat antioxidants. Storage at room temperature after irradiation further improves food acceptability.

Samples of commercially canned food have been irradiated at room temperature without opening the cans. In these instances sardines in oil and baked beans and tomato sauce showed no obvious change except a slight bleaching and some loss of characteristic flavor. Low oxygen content of canned foods is believed to be of considerable advantage during irradiation. Meat and fish paste in glass jars became bleached, and developed strong unpleasant odors and flavors.

The potential processes can be classified approximately as follows: 1. Sterilization (1 to 2 x 10^6 rep) of (a) products not previously sterilized (e.g., raw meat and fish); (b) products for which reasonably satisfactory methods of preservation are already available (e.g., cured meats, canned fruits, and processed foods); and (c) the surface only (few products deteriorate merely as a result of surface effects, and this use is therefore limited). 2. Incomplete destruction of harmful microorganisms (10^5 to 10^6 rep), resulting in (a) increase of the natural storage life, either by irradiation in depth or on the surface only; (b) killing of known harmful microorganisms (e.g., Salmonellae in egg); and (c) elimination of residual organisms in products already treated by other means (e.g., filtration or mild heating). 3. Use of low doses (10^4 to 10^5 rep) for the (a) control of insect infestation; and (b) possible inhibition of ripening of fruits. 4. Ancillary uses, e.g. sterilization of packaging materials.

Fifty-two references are cited.

3.249

spectra of the substrate. The latter give a more accurate picture of the oxidative changes at the double bonds of the substrate than does O uptake in the Warburg app.

3.12 PILOT TESTS WITH BACTERICIDAL ADMIXTURES TO ICE USED FOR FISH STORAGE

Partmann, W.
Kaltetechnik 6, 66 (1954)
Food Manufacture 29, No. 6, 239 (June, 1954)

Pilot scale experiments with a number of bactericidal admixtures to ice for use in the preservation of fish have been carried out at the West German Federal Research Institute for Food Preservation, Karlsruhe, Germany. A mixture consisting of the muscle from fresh tench and codfish was stored up to 20 days at 1°C. in the presence of the different bactericidal compounds. After storage the fish muscle was analyzed for taste, basic nitrogen content, tyrosine nitrogen content, and the number of bacteria present. Formaldehyde and Salthion, a proprietary sulphonamide product, gave the best bactericidal effect when mixed with ice. The effect of certain sulphonamides on fish bacteria is so striking that further confirmation of results on a larger scale will be carried out.

 ABSTRACTER: Martin Heerdt

5.120 VITAMIN A IN MILK. VI. THE INFLUENCE OF CONTINUED INTAKE OF SHARK-LIVER OIL ON THE VITAMIN A CONTENT OF MILK AND BUTTERFAT

Nanayanan, K. M.; Anantakrishnan, C. P.; and Sen, K. C.
Indian J. Dairy Sci. 6, 67-74 (1953)
Chemical Abstracts 48, No. 6, 3501 (1954)

Feeding cows and buffaloes 100,000-200,000 international units (I.U.) of vitamin A as shark-liver oil (I) per head per day for 7 weeks and for 22 weeks had no effect on milk yield or fat %. In a green-fodder regime with carotene intake at 1241-1385 mg. per head per day, I produced no increase in vitamin A of the milk fat of either animal. At a lower carotene intake of 300 mg. per head per day, I showed a temporary increase in the vitamin A content of the milk fat. Supplementation with I slightly decreased the carotene content of the milk fat of the cows. In a dry-fodder regime, supplementation with I increased the vitamin A content of the milk fat of both animals, a dose of 200,000 I.U. per day resulting in a max. av. total vitamin A potency of 1066 I.U. and 1155 I.U. per lb. of milk, resp., representing vitamin recoveries of 4.5 and 6.7%, resp.

 Reprinted in whole

7.53 A STUDY OF METHODS OF TESTING AND SAMPLING FOR THE DETERMINATION OF FAT CONTENT OF GROUND MEAT

Kelley, D. C.; Guerrant, V. C.; and Mackintosh, D. L.
Food Technology 8, No. 6, 273-76 (June, 1954)

Rapid methods of fat determination in ground meat are reported. The results of the findings are in all cases compared with the standard ether extraction A.O.A.C. method. The authors stress the importance of a rapid method for the estimation of fat in ground meat that will meet the requirements of both packer and inspector. These requirements include: simplicity in procedure, rapidity in making the test, and a fine comminution of the sample material to obtain as homogeneous as sample as possible.

Three different groups of tests were undertaken (duplicate samples) using an acetic and sulfuric acid mixture and a second reagent, the Minnesota reagent, with and without centrifuging. Three photos show the apparatus used and the data are recorded on three tables under like headings.

A review of previous methods and procedures is given, pertaining both to process control and research experimentation. Ten references are given in the bibliography, five of which are unpublished work.

Full details of procedures are given for each of the three groups. The authors summarize their work as follows:

"The results obtained from (a) the Modified Babcock method of rapid fat determination, using sulphuric acid with centrifuging, and those from (b) the ether extraction method, compared closely

(over)

 ABSTRACTER: Wm. Clegg

1.83 SOUTH AFRICAN SEA-FOOD INDUSTRIES

Anonymous
Food Manufacture 29, No. 6, 249 (June, 1954)

Fishery products from the coastal waters of the Western Cape have recently become the basis for two new industries. The abalone, or perlemoen, a large shellfish which grows in shallow water around the Cape coast is now economically important as a canned product. Canned abalone is exported chiefly to the Far Eastern countries, such as Malaya, where it is regarded as a delicacy.

Abalone are collected by teams of divers operating from fishing craft or from the shore at low tide. One skilled diver is able to harvest 500 or more of the abalone daily. The diver receives 3d. to 5d. for each abalone and a skilled diver, reportedly, can earn a good income.

The increased demand for this shellfish has created a danger of over-fishing and many readily accessible shallow banks have already been denuded. Regulations specifying a minimum diameter below which the young shellfish may not be lifted are expected in the immediate future. It is also planned that commercial taking of abalone will be confined to diving from boats.

The other novel food product now being offered on the South African market is a powder made from seaweed. This product reportedly contains valuable mineral salts, and it is recommended as a dietary supplement. The powder is now being produced commercially in a factory at Onrust River, near Hermanus, with seaweed harvested locally. In the past, animal feed supplements have been made from seaweed by a process of cleaning, drying, and grinding. This is the first time, however, that a seaweed dietary supplement has been prepared for human consumption.

(over)

 ABSTRACTER: Martin Heerdt

7.53

(significant difference in .08% of tests) when the samples were ground and mixed five times.

The rapid method of fat determination without centrifuging after digestion with sulphuric acid was not a satisfactory method of fat determination in ground meat. The results vary from results obtained by the ether extraction (A.O.A.C.) method.

The use of the Minnesota reagent in the Modified Babcock method with centrifuging and the rapid method of fat determination without centrifuging is not satisfactory because of variable results and inability to bring about complete disintegration of the tissues and release of all the fats.

Complete mixing and grinding of the samples is essential in order to get as representative a sample as possible for testing, regardless of the method employed.

Seasoning added to pork sausage interferes with the accuracy of the fat determination by the Modified Babcock method. The lower meniscus of the fat column in the neck of the Paley test tube is not distinct for reading."

1.83 (Cross Reference: 6.3)

The seaweed powder has a pleasant odor and can be used in cooking or by sprinkling on foods. A typical analysis of the common Cape seaweed, Ecklonia, shows an appreciable amount of nearly 20 different trace elements in addition to the customary potassium, sodium, calcium, and magnesium salts.

6.3 OBSERVATIONS ON THE IODO-AMINO-ACIDS OF MARINE ALGAE USING IODINE-131

Scott, Richard (Institute of Seaweed Research, Inveresk, Midlothian)
Nature 173, No. 4414, 1098-99 (June 5, 1954)

Iodine has been reported to occur in marine algae as inorganic iodide and iodo-tyrosines. The chemical stability of the iodine atoms in iodo-amino-acids was found by comparing chromatograms of the substances remaining after barium hydroxide treatment with those of the starting materials, the acids being made visible by spraying with ninhydrin. The exchangeability of the iodine atoms was determined by autoradiography. If simple exchange occurred, radioactive spots were detected in positions coincident with those of the original materials, whereas if new radioactive compounds were formed their activity was found in other positions.

Milligram quantities of tyrosine, diiodotyrosine, thyronine, diiodothyronine, triiodothyronine, thyroxine, dibromotyrosine and dibromothyronine were boiled under reflux for 18 hours with saturated barium hydroxide and a few microcuries of iodine-131 as iodide. In each case (after precipitation of barium as carbonate) the reaction mixture was separated chromatographically with an n-butanol/dioxane/2 N ammonia mixture, and the positions of labelled compounds determined. On every occasion iodide was strongly detected in the final mixture; but, with tyrosine, principally monoiodotyrosine and also traces of three unknowns were found. Labelled diiodotyrosine, together with traces of an unknown, and monoiodotyrosine were formed from the parent diiodotyrosine. A large range of labelled materials, including the monoiodo- and diiodo-tyrosines, was derived from thyronine, but labelling of the compound occurred only with diiodothyronine. Triiodothyronine seemed to be mainly changed to the diiodo- compound, and both these substances were labelled. The iodo groups of thyroxine appeared to be stable on treatment with alkali, but with 6 N hydrochloric acid were readily labelled.

(over)

 Reprinted in part

0.5 SPOILAGE PROBLEMS IN FRESH FISH PRODUCTION

Castell, C. H.
Canadian Fisherman 41, No. 4, 13-17 (April, 1954)

This is the first in a series of articles prepared by the author on the subject of fish spoilage. It is written in non-technical language for the benefit of fishermen, processors, and all who may handle fresh fish.

As an introduction to the problem, the present article discusses the bacteria themselves: their size, rate of reproduction, the different kinds of bacteria, their function in nature, their mode of action, and their distribution. The information may be summarized as follows:

(a) Bacteria are minute living organisms found almost everywhere in nature.
(b) When conditions are right, they have enormous powers of reproduction.
(c) The chief function of bacteria in nature is to break down plant and animal tissue and other complex organic materials.
(d) Their mode of action is by means of the enzymes that they secrete.
(e) Because bacteria differ in the numbers and kinds of enzymes they secrete, the extent and the kind of spoilage they can produce also differ.
(f) Living fish in their natural habitat already harbor the bacteria that will ultimately decompose them.

(over)

 ABSTRACTER: Roy C. Stevens

IODO-AMINO ACIDS OF MARINE ALGAE

BACTERIOLOGY OF FISH SPOILAGE

9.11 THE NATIONAL INSTITUTE OF OCEANOGRAPHY

Deacon, G. E. R.
Nature 173, No. 4413, 1014-16 (May 29, 1954)

The National Institute of Oceanography has been on its own premises -- leased from the Admiralty by the Bridewell Trust -- halfway between London and Portsmouth at Witley for a little longer than a year. The fact that the Institute is 35 miles from the sea is not detrimental since it uses information gathered from many different installations located around England's shores.

Long-term research is stressed, but immediate practical problems dealing with other laboratories and marine industries are also handled. Facilities are available to researchers from universities and other laboratories for making deep-water observations. The Institute also has an up-to-date library.

The Institute is striving for better understanding of the basic physical, biological, and chemical properties of the ocean. Research programs underway are as follows:

1. Interchange of energy between atmosphere and oceans. This project is concerned with transport of heat from one part of the ocean to another and with the transfer of momentum from the wind to the sea.

2. Response of the sea surface. Wave recordings are being taken from shore and ship installations for the purpose of predicting the wave spectrum in storm areas and at the coast. Wind drift is also being studied in the Strait of Dover and in the sea west of the British Isles.

(over)

 ABSTRACTER: M. R. Greenwood

9.11 OFFICE OF NAVAL RESEARCH LABORATORY OF OCEANOGRAPHY AND HYDRAULICS LABORATORY, WOODS HOLE, MASSACHUSETTS

Lill, Gordon, C. (Geophysics Branch, Office of Naval Research, Washington, D. C.)
Nature 173, No. 4413, 1017-1019 (May 29, 1954)

Due for completion in June 1954 is the new Oceanography and Hydraulics Laboratory being built for the Office of Naval Research in the village of Woods Hole, Massachusetts. This site for the new laboratory was chosen because of the proximity of the Marine Biological Laboratory and its comprehensive Oceanographical library, the Woods Hole Oceanographic Institution, and the U. S. Fish and Wildlife Service Laboratory.

It is believed that the new facilities will be of great benefit to all of the scientific groups concentrated in this area. More space will be available for private scientists at the Oceanographic Institution and the Marine Biological Laboratory when Navy work that was previously contracted to those laboratories is carried on in the new buildings.

Two buildings are to be built: a laboratory of oceanography, and a hydraulics laboratory. The oceanography laboratory will be a three-story steel and concrete structure with a combined floor space of 28,000 square feet. Adjoining it at the rear will be a presently-existing one-story building which will be altered and extended. On the first floor will be two large conference rooms, private offices, an underwater acoustics laboratory and a photographic dark room. The second floor will be used for instrument development, drafting and reproduction work and the third floor will be occupied by the hydrographic laboratory group. At regular intervals throughout the building, service outlets will be installed providing electricity, gas, fresh water, salt water and compressed air. An oil-operated hydraulic lift with a lifting capacity of 5,000 pounds will be installed near the center of the building. The various work areas will be separated by movable partitions of rolled or pressed steel.

(over)

 ABSTRACTER: Keith A. Smith

BRITISH INSTITUTE OF OCEANOGRAPHY

NAVAL OCEANOGRAPHIC LABORATORY

0.5 (Cross Reference: 2.01)

AN OUTLINE OF THE PRODUCTION, PROCESSING, AND DISTRIBUTION OF FRESH FILLETS, SHOWING SOME OF THE MOST IMPORTANT PLACES WHERE THE FILLETS BECOME CONTAMINATED, OR WHERE THE BACTERIA ALREADY ON THE FISH HAVE AN OPPORTUNITY TO INCREASE, TOGETHER WITH SUGGESTED CONTROL METHODS.

Location	What can happen	How to avoid or reduce it
The deck of the vessel	Fish become physically damaged and subsequently spoil more rapidly.	(1) Prevent softening of fish by over-exposure to sunshine. (2) Keep catch small in bulk. (3) Do not crush or bruise the fish in handling.
The deck of the vessel	Fish become bodily contaminated with bacteria.	(1) Gut fish thoroughly — remove all traces of liver and kidney tissue. (2) Wash gutted fish to remove excess blood, slime, and feces. Use clean water. (3) Do not allow fish to warm up in pens.
The holds of the vessel	Spoilage bacteria increase rapidly and some fish begin to deteriorate.	(1) Use only clean washed natural ice or artificial ice. (2) Chill fish quickly by thorough and uniform icing. (3) Do not pile fish in thick layers and cool slowly in centre. (4) Use sufficient ice.
The wharf	Bacteria continue to grow	(1) All fish held over before cutting should be thoroughly iced or held at 31°-32°F. (2) Round and gutted fish and fillets only those above a certain standard for fresh fillets.
The cutting line	Bacteria transferred from surface of round fish to surface of fillets.	(1) Wash round fish immediately before cutting. (2) Use care to prevent contamination during cutting and skinning. (3) Wash tables etc., frequently with water to remove slime. (4) Where possible, use mechanical fillet cutter. (5) Where it is practical, use disinfectant on surfaces.
During transportation, storage and in the retail store	Bacteria on fillets increase rapidly and fish may spoil.	(1) Use nitrite dip. (2) Chill fillets rapidly after packaging. (3) At all times hold fish as near as possible to 31° or 32°F. (4) Never expose fish in warmed-up show-cases.

9.11

The hydraulics laboratory will be built at the rear of the site. It will be of wood frame construction and will contain a 4-foot deep by 4-foot wide flume 100 feet long, and a circular tank 2 feet deep and 20 feet in dia ameter, There will also be a metal-working shop and a small balcony office in the building.

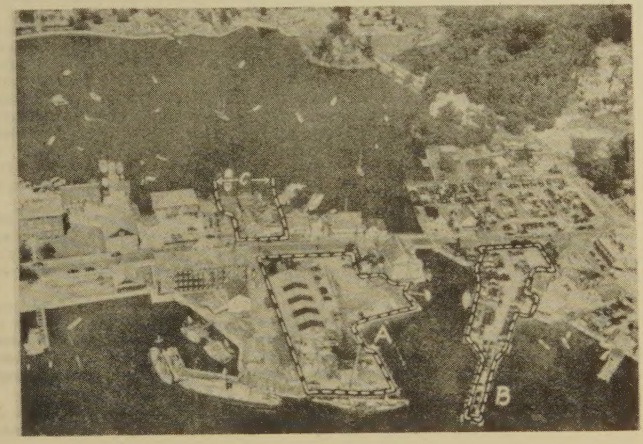

Fig. 1. Three sites, *A, B, C*, at Woods Hole, considered for the Laboratory of Oceanography; site *A* was chosen. The Marine Biological Laboratory is at the left; Woods Hole Oceanographical Institution is left centre; Bel Pond is in the background

6.3

Dibromotyrosine, in the presence of labelled iodide, produced a strong spot in a new position believed to be due to iodo-bromotyrosine, while dibromothyronine probably gave some diiodo- and iodo-bromothyronine.

If any of the above substances, with the exception of thyroxine, were present in their free state within marine algae, they ought to be detected as labelled compounds on hydrolyzing the finely minced algae with barium hydroxide in the presence of iodine-131. In accordance with this view, a few grams each of Rhodymenia palmata, Laminaria digitata (stipe and frond), Fucus vesiculosus and Ulva lactuca were individually reduced to a fine slurry with a serrated roller and plate. 10 c. c. of water and 5 gm. of barium hydroxide were added, together with a few microcuries of iodine-131, and the whole boiled under reflux for 18 hours. As before, excess barium was precipitated as carbonate, which was removed, together with the weed residue, by centrifuging. After acidification with 2 c. c. of 6 N hydrochloric acid, the solution was extracted with two 10-c. c. portions of butyl alcohol. These combined extracts were evaporated to dryness, taken up in a few drops of methyl alcohol and chromatographed as previously. All chromatograms yielded two radioactive spots, one corresponding to iodide, the other being a fast-moving spot about R_F 0.9.

For comparison, samples of the above algae, which had been maintained in sea water containing iodine-131 for one week, were minced and hydrolyzed as before. In the case of L. digitata, the stipe and frond were treated separately. Radioactive iodide was present in each chromatogram, being the sole constituent in the L. digitata stipe. In addition, F. vesiculosus contained a small trace of the fast-moving spot about R_F 0.9. R. palmata, U. lactuca and L. digitata (frond) had activity in the position of mono- and di-iodotyrosine and a trace of a substance at the same R_F as that produced by the action of iodide on dibromotyrosine. Both R. palmata and U. lactuca also possessed traces of a substance in the position of triiodothyronine. In U. lactuca the fast-moving spot at R_F 0.9 was strongly represented.

With the exception of L. digitata stipe and F. vesiculosus, these results appear to support the view that iodine is metabolically incorporated in marine algae.

9.11

(3) Wind-driven and thermodynamic circulation in the oceans. Both surface and deep-water currents are being studied with the aid of current meters and acoustical apparatus.

(4) Free and forced oscillations in the oceans. Velocities due to tides and internal waves are being studied with an apparatus to measure small pressure changes in deep water.

(5) Factors governing the distribution of marine organisms. Material already collected by the Discovery Committee is being used to determine movements and distribution of pelagic organisms.

(6) Taxonomic and faunistic work. The organisms from the collection mentioned above are being identified by specialists from museums and other institutions.

(7) Productivity of ocean waters. Work is being done to define and explain the normal distribution of, and regular variations in, the quantities of organisms.

(8) Whale research. The principle object of this project is to acquire knowledge for the sustained and efficient exploitation of whales.

(9) New methods. Both expensive research and less expensive practical apparatus are being developed for determining the various marine phenomena. Fishing methods and equipment are also being developed.

(10) Movements of sand and beach material. This project is throwing light on factors that influence the growth and changes in offshore bars and harbor approaches.

6.71 PEPSIN FROM FISH STOMACH

Isupov, V, S.
Rybnoe Khozyaistvo 26, No. 1, 38-40 (1950)
Chemical Abstracts 47, No. 15, 7564 (1953)

Two processes are reported for the production of pepsin from the stomachs of pike and pike perch (Zander). About 300-350 kg. of the stomach substance is required for the production of 1 kg. of pepsin. This yield is as high as that obtained from the mucous membrane of swine stomach. A very thorough digestion of protein can be accomplished with pike pepsin in 6 hrs. at 15°. Even at 0° digestion is complete in 24 hrs. With swine pepsin protein digestion is most intense at 38°. Protein is much more rapidly hydrolyzed by the pike pepsin than by hog pepsin. The synthesizing properties of fish protein are greatest at 15°. The agreement between the optimum temps. for proteolysis by the fish pepsin and for reversal of the process by the same enzyme is especially important from the standpoint of pharmacotherapy.

Reprinted in whole

6.190 DOES IT PAY TO FEED BREEDER MASH?

Parkhurst, Raymond T.
Southern Fisherman 14, No. 4, 95-96 (April, 1954)

Although there is still much to be known about the factors present in animal proteins and of their interrelationships, it has been demonstrated that they are of high nutritional value for good hatchability in poultry.

Fed on a comparable basis, a breeder feed always costs more than a layer feed. This is because of the cost of the animal proteins and vitamins necessary for maximum hatchability that are additional to those necessary for maximum egg production. Layer and breeder rations often have the same protein content, but the quality or kind of protein differs in the two rations.

In addition to the unknown factor or factors associated with animal proteins, vitamin B_{12} and riboflavin are of considerable importance when considering maximum hatchability and chick quality. Because it is probable that there is an unknown hatchability factor or factors present in dried distillers' solubles, butyl fermentation products, dried whey or dried yeast, these products are often used as supplementary sources of riboflavin. Riboflavin may also be added economically in the synthetic or powder form.

A vitamin B_{12} supplement is often added to breeder rations containing natural sources such as fish meal, fish solubles, and liver meal. This is done to provide a safety factor, since the natural sources fluctuate in their content of vitamin B_{12}.

(over)

ABSTRACTER: Roy C. Stevens

6.130 FRESHWATER FISH TRIMMING AND OFFAL UTILIZATION IN BY-PRODUCTS

Lantz, A. W. (Pacific Fisheries Experimental Station, Vancouver, B. C.)
Fishing Gazette 71, No. 4, 140B, 144 (April, 1954)

A survey of fish processing industries in the Prairie Provinces of Alberta, Saskatchewan and Manitoba, Canada showed that large quantities of fish and fish trimmings unfit for human consumption were being dumped or disposed of at a complete loss. To determine the possible commercial value of this material, a trial lot was processed into fish meal at a Prince Albert, Saskatchewan plant. The mixture consisted of 2,992 pounds of cold-storage whole tullibee and whitefish, and 3,608 pounds fish trimmings and offal. A steam-jacketed cooker and meat press were used, and the following yields were obtained from the 6,600 pounds of raw material: fish meal, 1,266 pounds; fish oil, 72 pounds. The composition of the meal was as follows: protein, 66.1 percent; oil, 12.7 percent; and moisture, 7.4 percent.

The production of fish meal is considered a practical means of disposing of these waste materials, provided, of course, that the meal has marketable value and that equipment that is not prohibitive in price can be secured.

Mr. Lantz describes the methods and equipment recommended for the various sizes and types of operation. Companies operating in remote areas would probably require portable equipment. In all cases, the initial cost of equipment should be considered in relation to efficiency of production operation, yield of meal and oil, and the quality of both meal and oil.

(over)

ABSTRACTER: Roy C. Stevens

6.199 THE EFFECT OF FISH MEAL ON THE RESPONSE OF CHICKS TO HIGH LEVELS OF PENICILLIN

Hill, C. H. and Kelly, J. W. (Department of Poultry Science, North Carolina State College, Raleigh)
Poultry Science 33, No. 3, 657-658 (May, 1954)

In 1953 the authors showed that chicks in new quarters and on a diet containing substantial amounts of animal products in the form of fish meal and whey responded only to relatively high levels of aureomycin. The authors decided, therefore, to determine what effect animal products in the diet had on the response of chicks to a high level of penicillin.

The chick room was thoroughly cleaned, washed with hot water and steam, and then fumigated with formaldehyde. Commercially hatched New Hampshire chicks, one day old and of mixed sex were placed on experiment in electrically heated batteries with raised wire floors. Feed and water were supplied ad libitum. Duplicate pens containing 15 chicks each were used with each treatment.

The basal ration fed consisted of soybean meal 47%, corn 47.7%, defluorinated phosphate 2.0%, limestone 1.5%, methionine 0.3%, vitamin mix 0.5%, trace mineral mix 0.5%, and salt 0.5%. All the known vitamins in the amount adequate to meet the requirements of the chick were supplied by the vitamin mix. The required amounts of iron, manganese, copper, zinc, cobalt, and potassium iodide were supplied by the trace mineral mix.

A constant protein level was maintained in the ration by decreasing the level of soybean meal in the lots to which fish meal was added.

(over)

ABSTRACTER: Martin Heerdt

6.130

The solvent method renders the material dry in the first operation and then solvents such as trichlorethylene or petroleum fractions are used to extract the oil. This method is recommended where only small quantities of oily fish are available. It is efficient from the standpoint of oil and meal recovery, but the equipment is said to be more expensive to install and operate than the simpler pressure-type.

Using the continuous type pressure extractor the raw material is cooked with steam, pressed in a continually revolving worm or screw and then dried. Oil separators are also included in the equipment. This method is used where fish are available in sizable quantities for an extended period of time. Cost of installation is high, but operating costs are fairly low.

Batch system equipment includes cookers, presses, dryers for the meal and settling tanks for the oil. Different types of batch cookers are used. Some are jacketed and may be operated under either pressure or partial vacuum. Most are operated under partial vacuum. Cooking times are dependent upon the material and the type of pressing. Relatively short cooking times are used if the material is to be wet-pressed. For dry-pressing, a higher vacuum is preferred and several hours cooking time to remove the water.

It is the opinion of the author that the batch system is best suited to existing conditions in central Canada or any inland fresh-water commercial fishery.

6.199

Procaine penicillin G at two levels, 4 and 40 mg/lb., were fed with both the all-plant protein ration and the ration containing 5% fish meal. The 4 mg/lb. level of antibiotic was found by Heuser and Norris (1952) to provide adequate growth response in chicks raised in conventional quarters. The results of this study appear in Table 1, below.

Both levels of penicillin as supplements to the all-plant protein ration failed to increase the weight of the chicks. In the presence of 5% fish meal, however, the high level of penicillin caused a significant increase in the weight of the chicks. This increase confirms the 1953 findings of the authors regarding the necessity of high levels of antibiotics to produce a growth response in clean quarters when fish meal is included in the ration.

The failure of both levels of penicillin to increase growth in chicks on the all-plant protein ration is somewhat surprising. It should be noted, however, that in this instance fish meal added to the basal ration did not increase the growth of the chicks and that excellent growth was obtained in all lots.

TABLE 1.—*Effect of fish meal on the response of chicks to high levels of penicillin*

Procaine penicillin (mg./lb.)	4 wk. wt. (gm.)	
	Fish Meal (%)	
	0	5
0	404 (27)	389 (29)
4	385 (28)	398 (30)
40	398 (30)	420[a] (30)

( ) Number of surviving birds.
[a] Significant at 2% level ("t" = 2.377) over lot receiving 5% fish meal and no penicillin.

6.190

The author concludes that "it does pay to feed a breeder mash because a good breeder mash will contain a high quality source of fish meal, fish solubles or liver meal, adequate sources of riboflavin and vitamin B_{12} together with unknown factors of value for high hatchability. The higher price for the breeder mash to cover these added values is a worthwhile investment. The returns are higher hatchability and better chicks. The better the results, the higher the price a hatchery can afford to pay for hatching eggs over market eggs."

0.5 SALT TOLERANCE OF MARINE BACTERIA

Venkataraman, R. and Sreenivasan, A. (Fisheries Technological Station, Hozhikode, S. India)
Food Research 19, No. 3, 311-313 (May-June, 1954)

Experiments were conducted with 134 pure strains of bacteria isolated from mackerel and sea water. Growth in media of various concentrations of NaCl was studied by adding the desired quantity of NaCl to nutrient sea-water broth or agar. Growth in media without salt was also noted. The percentages indicated in the table below represent the grams of NaCl added to 100 cc. of the nutrient broth or agar medium. The cultures were incubated at 37° C., and growth was determined at 24 hours, 48 hours and after one week.

Results of the study showed that all the Micrococci, Bacillus, Sarcina, and Bacterium species grew as well in fresh water media as in sea water media. Sixteen Achromobacter, 4 Flavobacter, 2 Pseudomonas, one Corynebacterium, and one Paracolobactrum and one Alcaligenes failed to grow without salt and therefore are considered strictly "marine" forms by ZoBell's definition. Among the "marine" Achromobacter, one tolerated 30%, three 25%, five 15%, two 10%, and five 7.5% of NaCl. The two Pseudomonas tolerated 15% NaCl, while all the four "marine" Flavobacter did not tolerate any salinity higher than that of sea water. The Corynebacterium also tolerated only 3.5%, the Paracolobactrum 10%, and the Alcaligenes 30% NaCl. The remaining 109 strains grew in both sea-water and fresh-water media. The salt tolerance of these strains in each genus is given in the following table.

 ABSTRACTER: Roy C. Stevens

0.33 A BROWNING REACTION BETWEEN THIAMINE AND GLUCOSE

de Lange, and v. d. Mijll Dekker, L. P.
Nature 173, No. 4413, 1040-1041 (May 29, 1954)

The authors discovered that a mixture of glucose and thiamine hydrochloride showed considerable browning when held at 85° C. in sealed glass tubes for several days. This experiment was repeated on a larger scale. Equal weights (3 g.) of glucose and thiamine-hydrochloride were thoroughly mixed and 0.250 g. of the mixture was sealed into small glass tubes. This mixture contained 1.5% moisture. Ten of the tubes were stored at 85° C. On each succeeding day one tube was removed from storage and held at room temperature. This continued until all of the tubes had been removed from the 85° C. storage. Each of the 10 samples was then dissolved in 100 ml. of distilled water The resulting solution was analyzed for the following: (1) glucose, by the cupric reduction method; (2) thiamine, (a) colorimetrically with absorption, (b) colorimetrical'y without absorption, (c) fluorometrically by the thiochrome method, and (d) microbiologically; (3) color, measured at 410 mμ; and (4) fluorescence measured against a standard quinine sulfate solution, 1 γ/ml. = 200.

Glucose and thiamine values (Table 1, this card, over) were calculated as a percentage recovery from a prepared mixture of equal weights of glucose and thiamine hydrochloride, respectively. These results indicate a reaction between glucose and thiamine hydrochloride. With prolonged heat treatment the amount of both components decreased significantly, whereas color and fluorescence increased. It was not possible to determine whether carbohydrate breakdown had occurred during heating. The reaction appeared to be limited to low moisture conditions since a solution of the mixture (250 mgm. /100 ml.) did not brown after heating at 85° C. for 10 days.

(over)

 ABSTRACTER: Martin Heerdt

4.21 REACTIONS OF PHOSPHORIC ACID IN THE AUTOXIDATION OF FATS

Privett, O. S. and Quackenbush, F. W.
Journal of the American Oil Chemists' Society 31, No. 6, 225-227 (June, 1954)

At the elevated temperatures used in accelerated stability tests phosphoric acid was shown to react with fatty peroxides in such a manner as to prevent their estimation by the usual iodometric methods. A dark, phosphorus-containing precipitate formed, which was apparently polymeric in nature.

Phosphoric acid also reacted with oxidized fat to form an undisassociated fat-soluble complex but did not react with fresh unsaturated fatty esters.

In addition to the well known sparing action of phosphoric acid on α-tocopherol, it was shown that α-tocopherol and quinone also exerted a marked sparing action on the phosphoric acid.

 Author's summary

0.33 CAUSE AND CONTROL OF THE BROWNING OF HEAT-PROCESSED FISH PRODUCTS

Tarr, H. L. A. and Bissett, Helen M. (Pacific Fisheries Experimental Station, Vancouver, B. C.)
Fisheries Research Board of Canada, Progress Reports of the Pacific Coast Stations, No. 98, 3-5 (April, 1954)

Previous reports have shown that the brown discoloration which frequently occurs during the canning of certain white-fleshed fish is due largely to Maillard ("sugar-protein") types of reaction and that ribose, formed post-mortem in the fish flesh, is largely or entirely responsible. This report discusses further work on the formation of ribose in fish muscle and an experimental method of removing it to prevent browning.

In certain varieties of fish (e.g. lingcod, rock cod species, and flounders) which have been stored at 32° F., free ribose usually develops in concentrations sufficient to allow browning (0.02 to 0.08%). Under these conditions little or no ribose is formed in salmon or halibut flesh. A study has revealed that the flesh of fish which form ribose post-mortem contains enzymes, riboside hydrolases, which act on ribosides formed by the breakdown of nucleic acids to yield ribose. The addition of riboside hydrolase enzyme preparations made from lingcod or rock cod to salmon or halibut causes formation of ribose when the fish flesh is stored at 32° F.

Light cooking of the flesh and removal of the exuded liquid before canning will eliminate some of the sugar, but during this heating some ribose combines with the muscle. A possibility of removing ribose by adding an enzyme that would break it down to unreactive products is being investigated. Molds, yeasts and bacteria are being studied with the hope that a "ribose oxidase" type of enzyme could be obtained free from their cells. Although such a preparation has not yet been obtained, tests

(over)

 ABSTRACTER: Neva L. Karrick

4.21 (Cross Reference: 4.69)

0.33 (Cross Reference: 3.30)

have been made using intact washed cells of Lactobacillus pentoaceticus as a crude "enzyme." When the cells were added in about 0.07% concentration to samples of fish in which free ribose forms post-mortem and these were stored for 2 days at 32° C., ribose could no longer be detected and the samples did not brown significantly when heated for one hour at 248° F. Addition of 0.05% ribose caused a marked increase in browning in fish muscle without added enzyme.

A quantitative method of determining browning was described in an earlier report. This method yielded the results reported in Table II. The lowest numbers indicate the brownest samples.

TABLE II.—Removal of ribose from fish flesh and its effect on browning.

Sample		Per cent reflectancy (inverse of amount of browning) occurring on heating fish samples stored 2 days at 32°F.		
		Rock sole	Rock cod	Lingcod
Samples without added enzyme	Fish alone (control)	38	26	31
	Fish plus ribose	30	23.5	28
	Fish plus adenosine	29	21	27.5
Samples with added enzyme	Fish alone	60	56	61
	Fish plus ribose	63.5	56	58
	Fish plus adenosine	56.5	53.5	60

0.5

TABLE 1

Salt tolerance of bacteria from sea water and mackerel capable of growing in media without NaCl

Genus	Number of species tested	Number of strains tolerating the maximum NaCl concentration of							
		3.5%	5%	7.5%	10%	15%	20%	25%	30%
Achromobacter	10	1	....	3	1	1	1	....	3
Micrococcus	21	....	....	4	8	8	1	....	....
Bacillus	45	2	3	9	9	10	1	7	4
Sarcina	14	....	....	....	12	2	....	....	....
Corynebacterium	2	....	....	....	....	1	1	....	....
Bacterium	3	1	....	....	2	....	....	....	....
Paracolobactrum	2	....	....	2	....	....	....	....	....
Alcaligenes	1	....	....	....	1	....	....	....	....
Flavobacterium	11	4	....	3	1	....	....	2	1
Total	109	8	3	21	34	22	4	9	8

0.33

The same experiment repeated with a mixture of arabinose and thiamine showed a considerable browning effect under the same conditions (table 2, below). This experiment was also carried out with glucose and a much lower concentration of thiamine hydrochloride; viz., 200 μg. thiamine per g. of sugar. One-gram samples of this mixture were heated in sealed glass tubes for 10 days at 85° C. The contents of these tubes were dissolved in 100 ml. of distilled water and analyzed as described earlier. The results appear in table 3, below, as averages of 6 similarly treated samples.

Spectrophotometric data from the undiluted solutions of the heated samples from this last experiment revealed a distinct absorption maximum at 285 mμ (figure 1, omitted). This curve could indicate the formation of hydroxymethyl furfural as a result of a glucose breakdown during the browning reaction, a fact which has been reported before by a number of authors. The glucose-thiamine reaction could be one of the factors that contribute to the well-known non-enzymatic browning of many processed foods. From the nutritional standpoint, the thiamine-glucose reaction might prove to be a major cause of the decreased thiamine content in a number of heat-treated foods.

Table 1

Days of heat treatment	Glucose (per cent)	Thiamine-hydrochloride Method a	Method b	Method c	Colour	Fluorescence	pH
0	96·2	101·2	101·2	101·2	0·000	5	3·8
5	89·2	96·8	91·4	—	0·082	44	3·7
10	69·2	91·6	87·4	87·4	0·178	56	3·6

Table 2

Days of heat treatment	Arabinose (per cent)	Thiamine-hydrochloride (per cent) Method a	Method c	Method d	Colour	Fluorescence
0	104·2	96	96	96	0·008	27
5	90·6	76	—	—	0·286	52
10	89·2	74	74	72	0·890	18

Table 3

Days of heat treatment	Glucose (per cent)	Thiamine-hydrochloride (per cent) Method a	Method c	Method d	Colour	Fluorescence
0	98·6	95	—	—	0·000	5
10	97·4	16	15	1	0·045	31

4.80 WHY IS WHALE OIL SO VALUABLE?

Anonymous
Western Fisheries 48, No. 3, 65 (June, 1954)

The term "whale oil" is used loosely to include all the fatty products derived from whales. However, in the market the term has to be more clearly defined.

Oils derived from the large baleen whale contain genuine fats, while those obtained from the spermaceti whale contain valuable wax alcohols and fatty acids with specific uses in many industries.

Whale oil is extracted from all parts of the whale and consists of approximately 45% blubber oil, 25% bone oil and 30% meat oil. All these oils are then blended into a high quality oil containing less than 2% free fatty acids. The color of the oil is dependent on the freshness of the raw material and the proportions of the different individual oils in the mixture. The largest amount of oil is obtained from the blubber and this oil is also of the lightest color. Like other marine oils whale oil contains a small amount of sulfurous matter. The properties of the oil are determined by its glycerine and fatty acid contents.

The hydrogenated oil finds extensive use in the food industry and also in the manufacture of fine quality soap.

In the refining of whale oil the soap settles to the bottom with the impurities. The soap solution is drawn off and the oil is washed and rewashed several times with hot water. The oil is dried under vacuum in special vats with bleaching earth for decolorization. The residue remaining from the refining process is treated and used by the soap industry or is split and distilled to make it available for other uses.

 ABSTRACTER: Roy C. Stevens

4.92 THE NUTRITION OF THE YOUNG AYRSHIRE CALF

Blaxter, K. L.; Brown, F.; and MacDonald, A. M.
Brit. J. Nutrition 7, 287-98, 337-49 (1953)
Chemical Abstracts 48, No. 6, 3497 (1954)

XIII. The toxicity of unsaturated acids of codliver oil

Calves were given a basal ration of dried skim milk with small supplements of α-tocopheryl acetate and added codliver oil or its fractions. Severe muscular dystrophy developed in calves given codliver oil or the total unsatd. acids of the oil. Slight dystrophy occurred in calves given the highly unsatd. acids of the oil. Calves which received the nonsaponifiable residue of the oil or the satd. fatty acid fraction did not develop dystrophy. Calves which received the less unsatd. acids did not develop dystrophy, but their musculature was pale. Muscles of both dystrophic and normal calves contained approx. the same amt. of total tocopherols. Dystrophic muscles contained the same amt. of tocopherol as contiguous normal muscles, or more. The toxicity of codliver oil to calves is caused by its polyunsat. fatty acids and not by hypervitaminosis A or D, and the toxicity may be a general effect of polyunsatn. rather than of a single polyethenoid acid.

XIV. Some effects of natural and synthetic antioxidants on the incidence of muscular dystrophy induced by codliver oil

Muscular dystrophy was induced by a diet of dried skim milk and codliver oil. dl-α-Tocopheryl acetate given by mouth increased the tocopherol concn. in the blood serum and protected the animal

(over)

 Reprinted in whole

1.87 THE CANADIAN LOBSTER

Anonymous
Trade News 6, No. 10, 9-10 (April, 1954)

The lobster Homarus americanus is found only on the eastern coast of North America in a range extending from the Strait of Belle Isle to the coast of North Carolina. It is most abundant in Maine, in the Maritime provinces, and on the south and west coasts of Newfoundland. Most lobsters are found at depths ranging from one to twenty fathoms. They are taken in commercial quantities all along the Canadian Atlantic coastline, but the areas of major production are located in Northumberland Strait, in the Gulf of St. Lawrence and off the coast of Yarmouth and Shelburne counties in Nova Scotia.

The upper part of the body of the lobster is protected by a hard shell, or carapace, projecting down on each side to cover the gills. Nineteen pairs of appendages extend from under the surface of the body. The color of the adult lobster varies from greenish-blue to reddish-brown. Contrary to popular belief its shell is red only after boiling.

Although the lobster is able to move rapidly from place to place by means of its tail fan, its swimmerets and its walking legs, it has been shown by numerous tagging experiments that populations are essentially local. It lives and feeds on the bottom, and in shallow waters it spends the daylight hours hidden in holes among the rocks or in other shady spots.

The diet of the lobster consists chiefly of fish, dead or alive, and of bottom-dwelling invertebrates such as mussels, clams, sea urchins, starfish, worms and crabs.

(over)

 ABSTRACTER: Roy C. Stevens

2.115 GLASS-RESIN BOAT HULLS DEVELOPED IN BRITAIN

Anonymous
Western Fisheries 48, No. 3, 34 (June, 1954)

A Portsmouth, England company has developed a method of boat hull construction using a glass-resin laminate. The material is a cold-setting polyester resin reinforced with glass thread and containing coloring and fire-proofing chemicals. It is claimed that the material has several advantages over wood.

The glass-resin is said to be unaffected by sea water and electrolysis and is immune to dry rot, wet rot, is non-magnetic and comparatively impervious to attack by teredos. The material is transparent to radar, does not become distorted or warped and, because of its resiliency, will not dent under impact. In addition, a hull constructed of this material is not expected to increase in weight more than 1% due to water absorption, whereas the weight of wooden hulls may be increased by as much as 20%.

The company does not plan to market finished vessels, but to produce a standard range of low-cost hulls for supply to boat yards for finishing as required.

 ABSTRACTER: Roy C. Stevens

WHALE OIL

THE AMERICAN LOBSTER

TOXIC EFFECTS FROM COD-LIVER OIL

GLASS-RESIN BOAT HULLS

1.87

Sexual maturity ranges from three or four years of age and seven to eight inches in length in warmer waters to eight or nine years of age and about 14 inches in length where the waters are cold. Mating takes place while the female is in the molting cycle and is in the soft-shelled condition. Sperm is deposited and may be retained by the female in sperm receptacles until the eggs are laid, from a month to a year later.

As a rule, mature females lay eggs only once every two years. Covered by a sticky secretion, the eggs are carried in a pocket formed by the curve of the tail for 11 or 12 months before they hatch. Hatching usually takes place from June to September. The young are about one-third of an inch long when hatched. They then rise to the surface to drift with the wind and tide for from three to five weeks, or until after the fourth moult, when they sink to the bottom and assume the form and habits of the adult.

Growth, like sexual maturity, is faster in warmer waters. In general, lobsters reach the size of six inches in about three years, and nine inches in about 4 1/2 years. In this time they will have moulted about 22 times. After maturity is reached, the female grows more slowly than the male. For example, a 15-inch male is about 10 years old, while a 15-inch female is generally over 16 years old. With increasing age the number of moults per year decreases.

4.80 (Cross Reference: 1.95)

4.92

against toxic action of the codliver oil unsatd. acids; intramuscular injection caused no increase in tocopherol concn. and resulted in only slight protection. Ascorbic acid in massive doses by mouth or by intravenous injection had no effect on blood or tissue tocopherol concns. and gave no protection. Large daily doses of Et gallate by mouth caused a systemic disturbance, but gave no protection. Biotin, intramuscularly, had no effect on the muscular dystrophy. Daily administration of one g. methylene blue protected against the codliver oil toxicity, but there was no increase of tocopherols in serum, muscle-liver, or perinephric fat. The concn. of blood serum tocopherols at the beginning of the expts. was correlated with the amt. of colostrum the calves had been given.

4.61 CONTROL OF RANCIDITY IN FISH FLESH. I. CHEMICAL ANTIOXIDANTS

Tarr, H. L. A.
Journal of the Fisheries Research Board of Canada VII, No. 3, 137-54 (June, 1947)

During recent years, there has been a growing literature on the use of chemical antioxidants for retarding the development of rancidity in animal and vegetable fats. Little attention appears to have been given, however, to the possible direct application of such compounds to animal flesh as a means of controlling oxidation of the fats in the flesh.

To retard "rusting", Bahr and Willie suggested that certain phenolic compounds such as hydroquinone, eugenol, or α-naphthol be added to the salt used in fish curing. It has been found that oat flour inhibits the onset of rancidity in salted mackerel. However, the antioxidant effect of the oat flour is weak, apparently being confined more to depressing the peroxide value of the fat than to improving the flavor of the fish. Silver has shown that rancidity in brine-cured mackerel and herring can be retarded if the cured fish is dipped in oil containing 0.2 percent nordihydroguaiaretic acid (NDGA). Smith, Brady, and Comstock have shown that NDGA, gossypol, and a mixture of d-isoascorbyl palmitate, soybean lecithin, and tocopherols retard rancidity in bacon.

In the present paper, it was reported that the rancidity in the fats of frozen fish was retarded by treatment of the fish with ascorbic acid (0.05 percent); ethyl, n-propyl, n-butyl, or hexyl gallates (0.01 to 0.05 percent); and cysteine hydrochloride (0.05 percent). Ethanol ammonium gallate (0.02 percent), dodecyl thiodipropionate (0.05 percent), thiourea (0.05 percent) and citric and tartaric acids (0.02 percent) were ineffective. The loss of surface red color that occurred during storage of coho and red spring salmon was largely prevented by pretreatment of the fish with 0.02 percent of

(over)

 ABSTRACTER: F. Bruce Sanford

8.6177 FACTORS INFLUENCING THE VITAMIN A AND D POTENCY OF GRAYFISH LIVER OIL SQUALUS SUCKLII (GIRARD)

Pugsley, L. I.
Journal of the Fisheries Research Board of Canada IV, No. 5, 312-322 (February, 1940)

A study of the variations in yield, colour and vitamin A value of the liver oil of grayfish as influenced by size, sex, pregnancy, locality and time of catching has been made. The mean yield and colour of the oil were 71.5 per cent and 3.5 Lovibond units of yellow respectively. These values were not significantly influenced by sex or time of catching. A lowered yield and a deeper coloured oil was obtained from the larger fish. The mean vitamin A value expressed in blue units per gram was 3,330. Wide variations were found which could not be ascribed to the sex of the fish or to the time of catching. The liver oils of the pregnant female fish and the large male fish had a higher value than the liver oils of the non-pregnant female and smaller male fish.

The E value of a representative group of the liver oils was determined and this was found to vary with the depth of the yellow colour of the oil. The ratio of the blue units per gram to $E^{1\%}_{1cm.}$ was 920 ± 169.

A representative sample of grayfish body oil was colourless and contained only 27 blue units of vitamin A per gram. The oil obtained from foetal livers also had a low blue value (63 blue units per gram). A sample of oil obtained from grayfish intestines contained 4,000 blue units per gram, but the yield was very low (1.5 per cent).

The vitamin D potency of three samples of grayfish liver oil was 4, 6 and 7 international units. These values did not show any relation to the corresponding vitamin A content of the oils, or to the size of the fish from which the samples of oil were obtained.

 Author's summary

6.237 THE ADSORPTION OF VITAMIN A FROM OILS BY SOAPS FORMED IN SITU

Brocklesby, H. N. and Kuchel, C. C.
Journal of the Fisheries Research Board of Canada IV, No. 3, 174-183 (December, 1938)

The soaps resulting from the alkali refining of animal and vegetable oils remove a certain amount of coloring matter. This removal process appears to be of a selective nature. For example, if salmon oil is neutralized with aqueous alkali under certain conditions, the yellow pigments in the oil are hardly affected; whereas, the red pigments are almost entirely removed by the soaps that are formed. These red pigments are carotenoids. In view of the structural relationship between the red pigments and vitamin A, it therefore seemed likely that vitamin A might also be adsorbed by soap.

In the investigation of this problem, it was found that the soaps formed in alkali processing removed vitamin A from oils by adsorption. The amount removed increased (1) with an increase in the water-to-soap ratio, up to 3,000 to 1; (2) with an increase in the free fatty acid content of the oil; and (3) with a decrease in the temperature of soap formation. Percentage adsorption plotted against the original vitamin content of the various oils gave a typical adsorption isotherm. Under comparable conditions, a preformed soap adsorbed 7 percent of the vitamins, whereas a soap found in the oil adsorbed 39 percent. Of the various soaps investigated, oleates showed the greatest adsorption. The adsorbed vitamin could be recovered quantitatively.

(over)

 ABSTRACTER: F. Bruce Sanford

3.5 EFFECT OF SALTING AND SMOKING ON SURVIVAL AND GROWTH OF CLOSTRIDIUM IN FISH

Castell, C. H. and Anderson, G. W. (Atlantic Fisheries Experiment Station, Halifax, N. S.)
Journal of the Fisheries Research Board of Canada VII, No. 2, 70-73 (May, 1947)

According to Tanner and Evans (1933), the salt tolerance of Clostridium varies with different strains of the same species and with the substrate to which it has been added. Their literature survey and experimental findings indicate that 10 to 12 percent sodium chloride is the highest concentration tolerated by Clostridium sporogenes, Cl. putrificum, and Cl. botulinum.

The experimental findings reported by the authors of this paper indicate that strains of the above species do not grow in media prepared from cod, hake, lobster, or pollock if the sodium chloride concentration of the media is 10 percent. Reducing the concentration of sodium chloride in the media to 8 percent, however, permitted growth to occur if the inoculum contained very large quantities of viable cells. Landerkin and Frazier (1937) made similar observations in studying facultative halophiles isolated from cheese salt baths. They discovered that growth in a high salt-content medium was a function of the quantity of the inoculum.

Whereas 8 to 10 percent sodium chloride checks the growth of all but gross contaminations of fish with Clostridium, considerably higher concentrations were without any apparent effect on Clostridium sp. spores. Active growth was obtained in less than 24 hours when spores from fish that had been held for about 6 months in saturated sodium chloride brine were inoculated into suitable media.

Moderately hard smoking, as well as the light brining that usually precedes smoking, also destroyed all but the spores of Clostridium sporogenes on fish.

 ABSTRACTER: Martin Heerdt

6.237 (Cross Reference: 5.119)

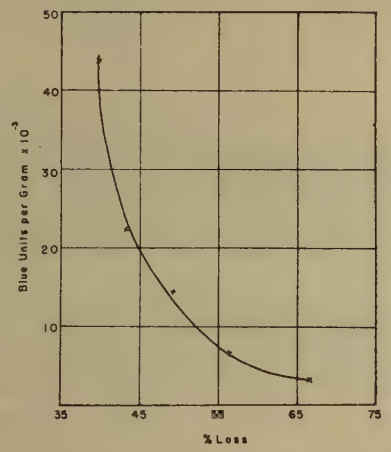

FIGURE 5. Relation between vitamin potency of original oil and loss by adsorption.

3.5 (Cross Reference: 3.4)

4.61

ethyl or propyl gallate. Both NaCl and $NaNO_2$ acted as pro-oxidants with frozen fish. In unfrozen salmon flesh stored at 0° C., both ethyl gallate and $NaNo_2$ retarded fat oxidation and bacterial increase.

3.5 STUDIES ON SALT FISH. VII. RED HALOPHILIC BACTERIA IN SEAWATER AND FISH SLIME AND INTESTINES

Hess, Ernest
Journal of the Fisheries Research Board of Canada V, No. 5, 438-439 (March, 1942)

Because the growth of red halophilic bacteria on salt fish results in losses to the processor, a study was begun to determine if the primary contamination were entirely from solar salts, from the bacterial flora of the sea water, or from the fish slime or intestines.

The author outlined his procedure as follows:

"In the present tests, Stuart's (1938) technique was followed, inoculating the samples of sea-water, fish slime and intestinal contents under aseptic precautions directly into large test tubes containing 25 ml. of sterile nutrient brine consisting of 25 per cent c.p. sodium chloride, 1 per cent peptone, 0.5 per cent calcium chloride and 0.5 per cent magnesium sulphate ($MgSO_4 . 7H_2O$) in distilled water. One ml. portions of the inoculated and uninoculated control tubes were withdrawn before and after incubation at 37° C. for 30, 60 and 90 days and plated on a modified Lochhead's (1934) skim-milk salt agar (25 per cent sodium chloride). The plates were then incubated at 37° C. for 30 days and all growths recorded."

The samples tested were taken near the outer entrance to Halifax harbor on 4 different occasions between October 1938 and September 1939. They consisted of 11 samples of sea water at the surface and at depths to 30 meters, 7 samples of fish slime, and 6 samples of intestinal contents. No red halophilic bacteria were isolated from the sea water samples nor the intestinal contents samples; however, cultures of red halophilic sarcinae were obtained from the slime of 2 different codfish,

(over)

 ABSTRACTER: D. T. Miyauchi

8.51 DISSOLVED NITROGENOUS MATERIALS IN THE EFFLUENT OF PILCHARD REDUCTION PLANTS

Beall, Desmond
Journal of the Biological Board of Canada 3, No. 2, 177-179 (January-March, 1937)

With the methods employed in 1937 in the pilchard reduction plants on the west coast of Vancouver Island, large losses of material occurred in the effluent discharged from the oil separation tanks. Such losses of material had been studied in 1933 by Beall, who determined the amounts of oil, suspended meal, and "dissolved protein" that the effluent contained.

The present paper is an extension of the work on the dissolved material in the effluent. Fractional protein analyses were made on various effluent samples. Other analyses were made to determine the amounts of dissolved nitrogen that constituted the alcohol-precipitable fractions that had been reported as "dissolved protein" in 1933. In addition, the amounts of total solids and ash were determined.

The methods used were as follows:

During the 1932 season, five samples were collected in quart bottles and preserved by the addition of 80 grams of ether per liter of liquid. One sample was taken early in the season; the remaining four, toward the end. The four samples differed one from another principally in the length of time the pilchards from which they were derived had been held before being processed.

The oil was removed by ether in a continuous liquid extractor. Total nitrogen was determined by the Gunning method, with copper as a catalyst. Fractional protein analyses were carried out by a

(over)

 ABSTRACTER: F. Bruce Sanford

3.17 ICES WITH SODIUM NITRITE AND SODIUM ACID PHOSPHATE FOR FISH PRESERVATION

Tarr, H. L. A. and Sunderland, P. A.
Journal of the Fisheries Research Board of Canada V, No. 3, 244-248 (July, 1941)

The authors enhanced the bacteriostatic action of sodium nitrite-water ices by incorporating an acid buffer salt. Four different ices having the composition shown in Figure 1 (this card, over) were prepared. The pH of the solutions obtained from these ices were, respectively, in the order of presentation, as follows: pH 6.5, 6.5, 5.0, 5.7. Five chum salmon (Oncorhynchus keta) weighing from 5 to 8 pounds each and landed 5 to 6 days after capture were placed in each of the 4 different ices in separate compartments of an insulated box. Fish from each kind of ice were withdrawn and examined after 4, 8, 11, 14 and 18 days of storage.

The results of these experiments are recorded in Figure 1 (this card, over) and in Table 2 (omitted). Ices containing sodium nitrite alone and sodium nitrite plus sodium acid phosphate, retarded bacterial spoilage and staleness more effectively than tap-water ices. Both of these ices gave about the same degree of protection from bacterial spoilage; consequently, no useful purpose was served by acidifying the sodium nitrite-water ice. Water ice containing sodium acid phosphate alone was not more effective in preventing bacterial spoilage than tap-water ice. The fish muscle used in this experiment was of a sufficiently low pH to permit the nitrite ices to exert marked bacteriostatic activity. Storage in ices containing sodium acid phosphate had no appreciable effect upon the pH of the fish muscle. The amount of sodium nitrite in the muscle of fish stored in sodium nitrite ices did not exceed 200 parts per million, and in many cases considerably less sodium nitrite was present. The intensity of red color of the cooked muscle of the salmon exposed to sodium nitrite was always greater than that of fish stored in nitrite-free ices.

(over)

 ABSTRACTER: Martin Heerdt

3.12 THE COMPARATIVE VALUE OF PRESERVATIVES FOR FRESH FILLETS

Tarr, H. L. A. and Sunderland, P. A.
Journal of the Fisheries Research Board of Canada V, No. 2, 148-163 (November, 1940)

The effect of a number of chemical preservatives in inhibiting the bacterial "spoilage" of fresh fillets of certain species of Pacific coast fish has been studied. The preservatives were applied by dissolving them in sodium chloride brines in which the fish were immersed. Chloroform (0.7%) markedly improved the keeping quality of treated fish, while hydrogen peroxide (0.1%) had little effect. Sulphurous acid (0.1% SO_2) considerably retarded bacterial "spoilage" but produced an unpleasant flavour. Hydrochloric acid (0.1%) slightly enhanced keeping quality but caused treated fillets to assume an unattractive appearance. Benzoic acid (0.1%) and sodium benzoate (0.1%) were quite effective, the former being slightly more active than the latter. Neither boric acid (0.1%) nor para-hydroxybenzoic acid ethyl ester (0.09%) were as efficient preservatives as benzoic acid or sodium benzoate in similar (per cent) concentration. Both sodium nitrite and potassium nitrite in 0.1% concentration caused a much greater inhibition in bacterial "spoilage" of fresh fillets than did sodium benzoate or benzoic acid, and the probable value of nitrites in fish preservation, as well as their influence on the colour of treated products, is discussed. The efficiency of a given preservative in different cases varied greatly, and in certain experiments a compound which normally exerted a favourable effect on keeping quality was without effect. The probable reason for this is discussed.

 Authors' summary

3.17

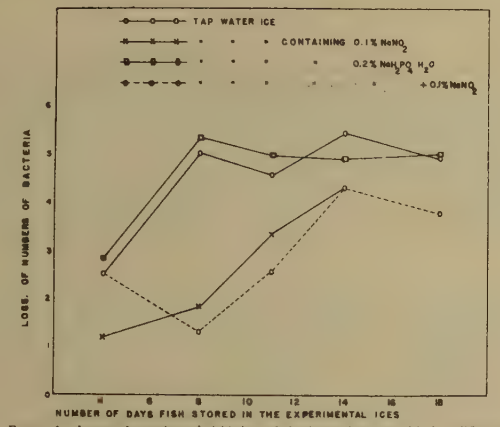

FIGURE 1. Increase in numbers of viable bacteria in chum salmon stored in four different ices.

3.5 (Cross Reference: 2.01)

sampled before the fish were taken aboard the boat. The author does not draw any general conclusions because of the narrow limitations in the number of samples, locality, and season.

8.51

modified method of Wasteneys and Borsook. The total solids were determined by heating a measured volume of effluent in a tared crucible at 98° C. until the residue became constant in weight, and the ash content was determined on this residue.

The nitrogen fraction constituting the "dissolved protein" reported in 1933 was determined by pipetting, with stirring, 25 milliliters of the effluent into 125 milliliters of "methyl hydrate." The resulting precipitate was dried at 50° C., weighed, and analyzed for nitrogen.

The amounts of total solids and ash are given in table 1, below. Although fluctuations occur in these values, they cannot be correlated with the time of season or the length of storage of fish before being processed. The fractional protein analyses gave the following average percentages of nitrogen: protein, 7.6; proteose, 35.9; peptone, 26.9; and sub-peptone, 28.5. "Dissolved protein" precipitated by "methyl hydrate" consisted of both protein and proteoses.

TABLE I. Details of samples collected, with their total solids and ash contents.

Sample	Date collected (1932)	Time of storage of fish before processing	Total solids g./100 ml.	Ash effluent
I	July 15	12 hr.	8.45	1.49
II		6 hr.	8.52	1.56
III	Collected	12 hr.	7.43	1.28
IV	between	30 hr.	7.94	1.29
V	September 1 and 14	36 hr.	8.51	1.20

0.37 THE PROBLEM OF "COMBINED" WATER IN BIOLOGICAL COLLOIDS

Guilbot, A.
Inds. agr. et aliment (Paris) 69, 7-13 (1952)
Chemical Abstracts 47, No. 6, 2569 (1953)

Review of the methods used in the detn. of the state of H_2O in macromols.

0.38 ADENOSINETRIPHOSPHATASE SYSTEMS OF MUSCLE. III. A SURVEY OF THE ADENOSINETRIPHOSPHATASE ACTIVITY OF MYOSIN

Mommaerts, W. F. H. M. and Green, Irving
J. Biological Chemistry 208, No. 2, 833-43 (June, 1954)

There is a sharp optimum at pH 6.4, at which point the activity is increased by high concentrations of Ca^{++} and rapidly deteriorates upon aging.

0.39 NATURE OF THE COLOR-CHANGING HORMONE IN CRUSTACEANS

Florey, Ernest
Biol. Zentr. 71, 499-511 (1952)
Chemical Abstracts 47, No. 14, 7122 (1953)

0.4 THE FUNGISTATIC ACTION OF SQUALENE ON CERTAIN DERMATOPHYTES IN VITRO

Sobel, Harry; Marmorston, Jessie; and Arzangoolian, Hilda
Science 119, No. 3101, 816 (June 4, 1954)

(Abstract of this article appears under 0.31 page 9 - August, 1954 issue)

0.5 STUDIES ON THE RED HALOPHILIC BACTERIA FROM SALTED FISH AND SALT

Venkataraman, R. and Sreenivasan, A.
Proceedings of the Indian Academy of Sciences 39, No. 1, Sec. B, 17-23 (1954)

(Abstract of this article appears under 3.5 page 11 - July, 1954 issue)

0.5 DESTRUCTION OF "RED HALOPHILES" BY ANTAGONISTIC BACTERIA

Dussault, H. P.
Fisheries Research Board of Canada, Progress Reports of the Atlantic Coast Stations, No. 58, 3-5 (April, 1954)

(Abstract of this article appears under 3.5 page 11 - August, 1954 issue)

1.95 WHY IS WHALE OIL SO VALUABLE?

Anonymous
Western Fisheries 48, No. 3, 65 (June, 1954)

(Abstract of this article appears under 4.80 page 13)

1.95 THE KILLER WHALE

Pike, Gordon
Western Fisheries 48, No. 1, 14-15, 50 (April, 1954)

1.95 TEST-TUBING ON THE WORLD'S BIGGEST MAMMAL

Pike, Gordon
Western Fisheries 47, No. 6, 17, 62, 64 (March, 1954)

2.00 SEAFOOD SPOILAGE INDICATOR

Hand, Wilfred C.
U. S. 2,826,855 (January 27, 1953)
Chemical Abstracts 47, No. 6, 2906 (1953)

Wooden sticks, preferably pointed at one end, are impregnated with phenol red, an alc. soln. of hematoxylin, or circumin and are used to test package seafood, raw or cooked, for traces of putrefaction.

2.00 MICROBIOLOGICAL DETERIORATION OF FISH POST MORTEM, ITS DETECTION AND CONTROL

Tarr, H. L. A.
Bacteriological Reviews 18, No. 1, 1-15 (March, 1954)

(Abstract of this article appears under 2.01 page 13 - July, 1954 issue)

2.00 CHEMICAL STUDY OF PUTREFACTION OF FISH MUSCLE. II. INFLUENCES OF PUTREFYING CONDITIONS ON THE DECOMPOSITION PRODUCTS

Higashi, Hideo; Okada, Minoru; and Yamade, Juami
Bull. Jap. Soc. Sci. Fish. 16, 377-87 (1951)
Chemical Abstracts 47, No. 16, 8280 (1953)

2.01 SPOILAGE PROBLEMS IN FRESH FISH PRODUCTION. II. BACTERIOLOGICAL PROBLEMS IN THE HANDLING OF ROUND FISH AT SEA

Castell, C. H.
Canadian Fisherman 41, No. 4, 13-17 (April, 1954)

(Abstract of this article appears under 0.5 page 7)

2.01 THE BACTERIOLOGY OF FRESH-WATER FISH

Venkataraman, R. and Sreenivasan, A.
Indian J. of Medical Research 41, No. 4, 385-392 (October, 1953)

(Abstract of this article appears under 0.5 page 1 - August, 1954 issue)

2.01 STUDIES ON SALT FISH. VII. RED HALOPHILIC BACTERIA IN SEAWATER AND FISH SLIME AND INTESTINES

Hess, Ernest
Journal of the Fisheries Research Board of Canada V, No. 5, 438-439 (March, 1942)

(Abstract of this article appears under 3.5 page 17)

2.01 THE UREA-SPLITTING BACTERIA CAUSING THE SPOILAGE OF FRESH FISH

Kimata, Masao and Hata, Yoshihiko
Mem. Research Inst. Food Sci., Kyoto Univ. No. 5, 55-64 (1953)
Chemical Abstracts 47, No. 21, 11594 (1953)

During the spoilage of various fish meats urea-splitting bacteria were isolated and their morphological and physiol. characteristics were described. The number of urea-splitting bacteria present in fish meats was about 5% of the total bacteria causing the spoilage and they did not vary in number with the kinds of fish, regardless of the amt. of urea contained in the meats. The urea-splitting bacteria isolated are classified into 2 major groups: one that grows well in a medium contg. urea as the only N source and produces a large amt. of NH_3 therefrom; and the other which do not grow on urea solely but need another N source and produce a large amt. of NH_3 from urea.

2.01 FRESHNESS OF FISH AND AMOUNT OF HISTAMINE PRESENT IN MEAT

Kimata, Masao and Kawai, Akira
Bull. Research Inst. Food Sci., Kyoto Univ. No. 10, 83-8 (1952)
Chemical Abstracts 47, No. 6, 2897 (1953)

III. Production of histamine during bacterial decomposition of fish meat. 1.

IV. Production of histamine during bacterial decomposition of fish meat. 2.

3.12 COLORIMETRIC NITRITE DETERMINATION

Dyer, W. J.
Journal of the Fisheries Research Board of Canada 6, No. 6, 414-418 (March, 1946)

(Abstract of this article appears under 7.89 page 17 - August, 1954 issue)

3.12 SALTING AND DRYING OF STOCKFISH

Willmer, J. S. and Rosenbrock, W.
Fishing Industry Research Institute (South Africa), Sixth Annual Report of the Director, 12 (March 31, 1954)

(Abstract of this article appears under 3.5 page 5 - August, 1954, issue)

3.12 COMPOSITIONS FOR PRESERVATION OF FISH

Yamada, Akio
Japan. 5049 (September 4, 1951)
Chemical Abstracts 47, No. 6, 2907 (1953)

An emulsion of 0.01% wood tar and 0.1% p-$HOC_6H_4CO_2Et$ or p-$HOC_6H_4CO_2Bu$ in water or in salt soln., is used for preservation of fish.

3.230 A COMPLETE COURSE OF STUDY IN FROZEN FOODS

Kinney, Richard R.
Frosted Food Field XVIII, No. 6, 19-28 (June, 1954)

The main subject headings are as follows:

I Definition of frozen foods
II Inner structure of foods
III What foods are
IV The freezing process
V How a mechanical freezer operates
VI The freezing of vegetables
VII The freezing of fruits
VIII The freezing of meat and meat products (structure of meat)
IX Packaging, storage
X Storage

3.230 FROZEN SHRIMP -- NOW 57% OF CATCH AND NO END OF GROWTH IN SIGHT

Anonymous
Quick Frozen Foods 16, No. 9, 89-90, 154 (April, 1954)

(Abstract of this article appears under 1.85 page 5 - July, 1954 issue)

3.33 PRESERVING FISH OF THE TUNA TYPE

Stevenson, Charles B. and Hodges, John A.
U. S. 2,635,050 (April 14, 1953)
Chemical Abstracts 47, No. 12, 6576 (1953)

Skinned, eviscerated, boned fish is cut into 2-3 lb. loins. The loins are dressed with a 1-3% brine soln., heat-treated about 20 min. with steam at 210-12° F. to coagulate the protein, cooled by a fine water spray, cleaned, cut into pieces, packed into cans, and processed.

3.33 "ANTI-STRUVITE" SALT DEVELOPED

Anonymous
Food Packer 35, No. 2, 66 (February, 1954)

A St. Louis company has recently perfected a new "Anti-Struvite" salt tablet which prevents the formation of the glass-like Struvite crystals in canned fish. The tablets can be deposited in cans of fish by a salt tablet dispensing machine or by hand, and cause no adverse effects on the color, texture, or flavor of the product, according to the manufacturer.

3.33 FISH HANDLING AND PROCESSING IN U.S.A. -- OYSTERS

Empey, W. A.
Fisheries Newsletter (Australia) 13, No. 3, 15-17 (March, 1954)

(Abstract of this article appears under 1.81 page 5 - August, 1954 issue)

3.4 PRESERVATIVE EXPERIMENT OF THE SMOKED SHARK FILLET

Yamamura, Yarokuro
Bull. Japan. Soc. Sci. Fish. 16, 433-4; 510-16 (1951)
Chemical Abstracts 47, No. 16, 8279 (1953)

I. Relation between the days needed to show decayed appearance and the temperature of storing.

II. Change of oil components
Shark meat from the abdomen contained more oil than from the back.

III. Production of ammonia
The NH_3 produced during the smoking process is derived from urea which was decompd. gradually by bacterial urease. The production of NH_3 was most effectively controlled by storing the meat at 2-8° and by keeping the water content below 30% and relative humidity below 76%.

3.4 EFFECT OF SALT AND SMOKING ON SURVIVAL AND GROWTH OF CLOSTRIDIUM IN FISH

Castell, C. H. and Anderson, G. W.
Journal of the Fisheries Research Board of Canada VII, No. 2, 70-73 (May, 1947)

(Abstract of this article appears under 3.5 page 15)

5.112 DECOMPOSITION OF VITAMIN A BY HEAT

Tsukamoto, Takeo and Tominaga, Tadashi
J. Pharm. Soc. Japan 68, 207-8 (1948)
Chemical Abstracts 47, No. 18, 9566 (1953)

Potency loss was approx. 10 % when heated at 120° for 2 hrs. and approx. 20% when heated for 5 hrs. When sterilized at 150-160°, potency loss was 8.4% in 15 min., 105% in 30 min.

5.112 A NOTE ON THE STABILITY OF VITAMIN A IN CANADIAN MARGARINE

Murray, T. K. and Campbell, J. A.
Canadian Journal of Technology 31, No. 9, 193 (September, 1953)

5.112 INFLUENCE OF VARIOUS VITAMINS ON THE STABILITY OF VITAMIN A

Katsui, Goichiro
Vitamins (Japan) 6, 66-7 (1953)
Chemical Abstracts 47, No. 10, 10174 (1953)

6.237 STUDIES ON VITAMIN A, D, AND RELATED SUBSTANCES BY MEANS OF MOLECULAR DISTILLATION. VII. VITAMIN A FRACTION FROM THE UNSAPONIFIABLE MATTER OF WHALE-LIVER OIL

Omote, Yoshimori
J. Chem. Soc. Japan, Ind. Chem. Sect. 54, 589-91 (1951)
Chemical Abstracts 47, No. 14, 7161 (1953)

Vitamin A concentrate was obtained at 125° by the mol. distn. of the unsaponifiable matter of whale-liver oil.

6.237 THE ADSORPTION OF VITAMIN A FROM FISH LIVER OILS

Swain, Lyle A.
Journal of the Fisheries Research Board of Canada 6, No. 2, 113-118 (August, 1943)

In experiments with fish liver oils, vitamin A alcohol was more readily adsorbed than its fatty acid esters or than triglycerides and other fatty acid esters. The vitamin A esters were less readily adsorbed than the triglycerides.

6.237 STUDIES ON THE MOLECULAR DISTILLATION OF WHALE LIVER OILS

Yamakawa, Takeshige, and Mori, Takajiro
Bulletin of the Japanese Society of Scientific Fisheries 18, No. 12, 675 (1953) (English summary and tables)

"Pollack liver oil was most suitable as a pickup oil. Optimum conditions of yield and quality of distillates on an industrial scale with a certain still were two cycles circulation at 290° C. in vacuum 10^{-4} - 10^{-3} mm. Hg and an average current speed of about 15 L/h."

LIST OF PUBLICATIONS REGULARLY ABSTRACTED

Analyst
Analytical Chemistry
Archives of Biochemistry and Biophysics
Australian Journal of Marine and Freshwater Research
Biochemical Journal
Bulletin of the Faculty of Fisheries, Hokkaido University
Bulletin of the Japanese Society of Scientific Fisheries
California Fish and Game
Canadian Fisherman
Canadian Journal of Chemistry
Canadian Journal of Technology
Canner
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemistry and Industry
Commercial Fisheries Review
Commercial Fisherman
Drug and Cosmetic Industry
FAO Fisheries Bulletin
Federation Proceedings
Feedstuffs
Fisheries Newsletter (Australia)
Fish. Res. Bd. Can., Prog. Repts. Atlantic Coast Stas.
Fish. Res. Bd. Can., Prog. Repts. Pacific Coast Stas.
Fisherman
Fishermen's News
Fishing Gazette
Flour and Feed
Food Engineering
Food Manufacture
Food Packer
Food Preservation Quarterly
Food Processing
Food Research
Food Science Abstracts
Food Technology
Foreign Commerce Weekly
Frosted Food Field
Industrial and Engineering Chemistry
Industrial Refrigeration
Journal of Agricultural and Food Chemistry
Journal of Applied Chemistry
Journal of Biological Chemistry
Journal of Home Economics
Journal of Nutrition
Journal of the American Chemical Society
Journal of the American Dietetic Association
Journal of the American Oil Chemists' Society
Journal of the Association of Official Agricultural Chemists
Journal of the Fisheries Research Board of Canada
Journal of the Science of Food and Agriculture
Maine Coast Fisherman
Meldinger Fra SSF (Herring Industry, Norway)
Modern Packaging
Modern Refrigeration
National Fisherman
National Provisioner
Nature
Nutrition Reviews
Pacific Fisherman
Pan American Fisherman
Poultry Science
Practical Home Economics
Progressive Fish-Culturist
Quick Frozen Foods
Refrigerating Engineering
Report of the Food Investigation Board (Great Britain)
Science
Southern Fisherman
Trade News (Fisheries Department, Canada)
Western Fisheries
World Fishing

Articles chosen for abstracting or inclusion as bibliographical references are those deemed of interest to the commercial fisheries and to fishery technological laboratories. Occasionally pertinent articles from sources other than the above listed publications are included. Biological papers are generally omitted.

6.3 THE PRODUCTION OF YEAST FROM SEAWEED

Tomiyasu, Yukio and Zenitani, Buhei
J. Agr. Chem. Soc. Japan 25, 406-10, 479-83 (1951-52)
Chemical Abstracts 47, No. 15, 7685 (1953)

I. Two species of Candida
Two suitable species have been isolated for the prepn. of food yeast from seaweed.

II. Method of producing yeast from seaweed. 1.

6.3 CHEMICAL STUDIES ON VOLATILE CONSTITUENTS OF SEA-WEED. II. ON THE VOLATILE ACIDS OF ULVA PERTUSA K.

Katayama, Teruhisa
Bulletin of the Japanese Society of Scientific Fisheries 19, No. 7, 793-97 (November, 1953)
(English summary, diagrams, and figures)

The following volatile acids have been found in the steam distillate of various fractions obtained from Ulva pertusa K.: acetic, propionic, butyric, valeric, myristic, linolenic and C_{16}-unsaturated acid.

6.79 THE PRESENCE OF ANDROGENS IN CHUM SALMON (ONCORHYNCHUS KETA WALBAUM)

Potter, Gilbert D. and Hoar, William S.
Journal of the Fisheries Research Board of Canada 11, No. 1, 63-68 (January, 1954)

Testes of mature chum salmon (Oncorhynchus keta Walbaum) were examined histologically for interstitial cells and extracts of the testes were asayed biologically for the presence of androgens. The histological examination showed numerous interstitial cells similar to those described in some other fish and in mammals. The bioassay established the presence of androgenic substance (probably testosterone). The amount present in salmon testes was calculated to be roughly equivalent to the amount present in mammalian testes.

6.79 GROWTH HORMONE FROM SALMON PITUITARY GLANDS

Jampolsky, A. and Hoar, W. S.
Journal of the Fisheries Research Board of Canada 11, No. 1, 57-62 (January, 1954)

Injections of an alkaline extract of the anterior lobe of beef pituitary produced a prolonged acceleration of growth in rats and a temporary increase in weight of goldfish. A comparable extract of salmon pituitaries (Oncorhynchus tshawytscha) had no effect on growth of rats but produced a slight temporary increase in growth of goldfish.

6.79 AGRICULTURAL ADHESIVES FROM FISH SPERM

Takaoka, Takashi
Japan 4199 (October 14, 1952)
Chemical Abstracts 47, No. 17, 9042 (1953)

7.89 DETERMINATION OF AGING OF FISH BY MEANS OF IODOMETRIC TITRATION

Truttwin, Hans
Z. Lebensm.-Untersuch. u.-Forsch. 97, 275-81 (1953)
Chemical Abstracts 48, No. 4, 2282 (1953)

The method comprises finely grinding the fish, mixing, shaking 1 g. sample with 50 ml. water in a glass stoppered 100-ml. Erlenmeyer flask, and titrating with standard I soln. from a 25-ml. buret with starch as an indicator. With 0.08% standard I soln. titration on cod is: fresh 5.1, stored 10 days 12.6, and stored 12 days, 18.2 ml. About a 14 ml. limit is recommended.

7.89 PALATABILITY OF SEA FISH (SALTED HERRING) BASED ON AMMONIA CONTENT

Wierzchowski, Jozef and Nowak, Janina
Roczniki Panstwowego Zakladu Hig. 3, 443-50 (1952)
Chemical Abstracts 47, No. 17, 8923 (1953)

The palatability of salted sea fish could not be predicated by its NH_3 content but by its H_2O and fat contents and an organoleptic examn.

7.89 COLOR MEASUREMENT. APPLICATION TO FOOD QUALITY GRADES

Hand, David B.; Robinson, W. B.; Wishnetsky, Theodore; and Ransford, J. F.
Journal of Agricultural and Food Chemistry 1, No. 20, 1209 (December 23, 1953)

8.50 COMPOSITION OF FOOD VALUE OF WHALE MEAT

Santos Merino, A.
Anales bromatol 5, 5-9 (1953)
Chemical Abstracts 47, No. 17, 8923 (1953)

Fresh whale meat sepd. from adipose tissue averages: water 69.3, protein 24.4, fatty matter 5, and ash 0.9%. Characteristics of the fat are: n_{40} 1.4593, I no. 117.0, sapon. no. 196.8, nonsaponifiable matter 1.32%.

8.50 CHEMICAL STUDIES OF SPANISH FISHES

Rodriguez de la Heras, A. and Mendez Isla, M. C.
Anales bromatol. (Madrid) 4, 403-10 (1952)
Chemical Abstracts 47, No. 14, 7120 (1953)

Moisture, protein (N x 6.25), ash, and energy content are reported on 47 samples of named species of fish.

8.50 CHARACTERISTICS OF THE LIVER OF THE BALTIC CODFISH

Poshogina, M.
Rybnoe Khozyaistvo 26, 41-3 (1950)
Chemical Abstracts 47, No. 18, 9566 (1953)

INT.-DUP. SEC., WASH., D.C. 65546

INDEX

Subject	Page No.	Card No.
African fisheries		
New South African seafood products	5	1.83
Analysis, organic		
Fat determination in ground meat	5	7.53
Antioxidants		
Phosphoric acid in oxidation	11	4.21
Chemical antioxidants	15	4.61
Apparatus and equipment, laboratory and plant		
New type dryer	3	6.131
Byproducts, miscellaneous		
Pepsin from fish stomach	9	6.71
Growth hormone from salmon	25	6.79
Androgens in chum salmon	25	6.79
Canned fish, general		
Browning in heat-processed fish	11	0.33
Canned fish, processing		
New tuna process	23	3.33
Anti-Struvite salt	23	3.33
Chemistry and biochemistry, miscellaneous		
Thiamine-glucose browning reaction	11	0.33
Browning in heat-processed fish	11	0.33
Bound water	19	0.37
ADTase activity of myosin	19	0.38
Composition, inorganic		
Food composition tables	1	8.0
Composition, organic		
Nitrogen fraction of sardine waste	17	8.51
Composition of whale meat	25	8.50
Composition, vitamins		
Food composition tables	1	8.0
Vitamin potency of grayfish livers	15	8.6177
Equipment, fishing vessel		
Aluminum alloys in ships	1	2.113
Fish liver oils, manufacturing of		
Adsorption of vitamin A by soaps	15	6.237
Molecular distillation of whale liver oil	23	6.237
Adsorption of vitamin A	23	6.237
Fish meal, nutritive value		
Poultry rations and hatchability	9	6.190
Fish meal and penicillin in chick diets	9	6.199
Fish meal and oil, manufacture		
New type dryer	3	6.131
Utilization of fresh-water fish waste	9	6.130
Whale oil	13	4.80
Freshness of fish		
Determination of freshness	25	7.89
Frozen fish, general		
Freezing fish at sea	3	3.234
Frozen fish, changes in during freezing and cold storage		
Changes during frozen storage	3	3.249

Subject	Page No.	Card No.
Gear, fishing		
Marine bait-worm industry	1	2.1127
Handling fresh fish		
Freezing fish at sea	3	3.234
Addition of bactericides to ice	5	3.12
Preservatives for fresh fillets	17	3.12
Lobsters		
The American lobster	13	1.87
Marine plant products		
D galactose from seaweeds	1	6.3
New South African seafood products	5	1.83
Iodo-amino acids of marine algae	7	6.3
Oceanography		
British Institute of Oceanography	7	9.11
Naval oceanographic laboratory	7	9.11
Oils, nutrition		
Toxic effects from cod-liver oil	13	4.92
Oils, utilization and marketing		
Whale oil	13	4.80
Preserved fish, miscellaneous		
Irradiation preservation	3	3.19
Preservatives and sanitation		
Addition of bactericides to ice	5	3.12
Preservatives for fresh fillets	17	3.12
Bacteriostatic ices	17	3.17
Rancidity		
Phosphoric acid in oxidation	11	4.21
Salt fish		
Bacteria in salted and smoked fish	15	3.5
Red halophilic bacteria	17	3.5
Shellfish and crustaceans, miscellaneous		
New South African seafood products	5	1.83
Smoked fish		
Bacteria in salted and smoked fish	15	3.5
Spoilage		
Bacteriology of fish spoilage	1	0.5
Salt tolerance of marine bacteria	11	0.5
Red halophilic bacteria	17	3.5
Seafood spoilage indicator	19	2.00
Histamine in spoilage	21	2.01
Urea-splitting bacteria in fish	21	2.01
Vitamins, vitamin A, chemistry		
Adsorption of vitamin A in soaps	15	6.237
Decomposition of vitamin A by heat	23	5.112
Vitamin A stability	23	5.112
Vitamin A from whale-liver oil	23	6.237
Vitamins, vitamin A, therapy		
Vitamin A in milk	5	5.120
Vessels, fishing		
Glass-resin boat hulls	13	2.115
Whales and other marine mammals		
Whale oil	13	4.80
The killer whale	19	1.95
Whale studies	19	1.95

Librarian
Pacific Oceanic Fishery Investigations
Box 3830
Honolulu, T.H.
128 S

United States
Department of the Interior
Fish and Wildlife Service
Washington 25, D. C.

Official Business